

# Rocket Science

*A Historic Context and Assessment of  
U.S. Army Cold War Properties  
1946-1989  
Redstone Arsenal, Alabama*



Historic Resource Assessments  
Fort Worth, Texas

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**Prepared for**

**Redstone Arsenal Support Activity  
Redstone Arsenal, Alabama**

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Fort Worth, Texas  
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Photograph from *Life* Magazine

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## MANAGEMENT SUMMARY

*Rocket Science* is a Cold War historic context and assessment of U.S. Army properties at Redstone Arsenal, Alabama. It was completed by Historic Resource Assessments to serve as a planning tool for environmental staff at Redstone Arsenal Support Activity (RASA). The report partially fulfills requirements of the National Historic Preservation Act of 1966 as well as Department of Defense (DOD) and Department of the Army guidelines and regulations.

Information for the historic context was obtained from a variety of sources. These sources included RASA, the History Office of U.S. Army Aviation and Missile Command, the Marshall Space Flight Center (MSFC), the University of Alabama-Huntsville, and the Huntsville-Madison County Public Library. Previous historic building surveys of Redstone Arsenal were also consulted. An architectural field reconnaissance was conducted for historic resources with a high probability of being eligible for the National Register of Historic Places (NRHP) within the post's Cold War historic context. Department of the Interior and DOD guidelines regarding historic resources and Cold War properties were used in evaluating properties for NRHP eligibility.

The Huntsville Arsenal and Redstone Ordnance Plant were established in 1941 southwest of Huntsville, AL. As part of a nationwide mobilization effort in preparation for World War II, these adjacent facilities worked together to produce chemical warfare ordnance. Following World War II, Redstone Arsenal became the research and development center for the U.S. Army's missile program. Dr. Wernher von Braun and his team of German rocket scientists arrived here in 1950. Tasked with the development of large liquid-fueled guided missiles, they contributed enormously throughout the 1950s to the field of modern rocketry.

U.S. Army activities at Redstone Arsenal during the Cold War included the research and development of the first guided missiles in America's nuclear arsenal. Missiles designed at Redstone Arsenal in the 1950s were exceptionally important in the Nuclear Arms Race. The short-range REDSTONE rocket was the United States' first operational ballistic missile capable of launching and detonating a nuclear warhead. JUPITER, America's first intermediate-range ballistic missile, was developed here by the Army Ballistic Missile Agency (ABMA). This missile played a major role in negotiations between the United States and Soviet Union in 1962 during the Cold War drama known as the Cuban Missile Crisis. REDSTONES and JUPITERs were vital to national defense until the U.S. Air Force began deploying intercontinental ballistic missiles in the early 1960s.

Rocket booster research and development at Redstone Arsenal was also applied to space exploration. Von Braun and his staff energetically led America in the Space Race against the Soviet Union. Their work resulted in ABMA's launch of EXPLORER I, the first American

satellite, in 1958. In 1960 the National Aeronautics and Space Administration (NASA) established the MSFC at Redstone Arsenal. Much of the Army property and personnel at the arsenal, including von Braun and his staff, were transferred to NASA control. With von Braun as its first director, the MSFC conducted research on launch vehicles for space exploration. Their work culminated in one of mankind's greatest feats, the first manned space flight to the moon in 1969.

As a result of research and fieldwork conducted for the Cold War historic context, this report recommends that the proposed Guided Missile Center Historic District be considered eligible for the NRHP. It is also recommended that Buildings 4381, 4484, 4488, 4489, 4722, and 4505, individual Army properties in Plants Area No. 1, be considered NRHP eligible. These resources are exceptionally important because of their associations with the Space Race and the Nuclear Arms Race. They should be considered eligible under Criteria Consideration G, a category that makes a property eligible if it has gained exceptional importance within the past 50 years.

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## 1.0 INTRODUCTION

*Rocket Science* is a Cold War historic context and assessment of U.S. Army properties at Redstone Arsenal, Alabama. It was completed by Historic Resource Assessments (HRA) to serve as a planning tool for environmental staff at Redstone Arsenal Support Activity (RASA). The report partially fulfills requirements of Sections 106 and 110 of the National Historic Preservation Act of 1966 (NHPA). Section 106 requires federal authorities to identify and take into account historical and archaeological properties before implementing projects. Section 110 requires federal authorities to identify and document historic properties that they own. This report also assists in fulfilling Department of Defense (DOD) Directive 4710.1, the integration of archaeological and historic preservation with planning and management activities; U.S. Army Regulation 200-4, which requires commanding officers to comply with federal cultural resource laws; and Army Regulation 420-40, which establishes base preservation plans as important planning, maintenance, and development tools.

Research and survey work were completed in order to establish a Cold War historic context for U.S. Army historic resources at Redstone Arsenal. Such a context must be created in order to accurately evaluate the significance of Cold War historic resources. Significant resources may then be considered eligible for the National Register of Historic Places (NRHP). Previous reports identified and evaluated World War II and Cold War buildings and structures, but a Cold War historic context was not included in either report. *Architectural and Historic Inventory of Buildings and Structures Dating to the Cold War-Era (1946-1989) at the Redstone Arsenal, Alabama* by Ruth D. Nichols of TRC Mariah Associates, Inc., makes recommendations on Cold War properties potentially eligible for the NRHP. These recommendations should not be used for further environmental compliance procedures because they were made without the benefit of a Cold War historic context. Appendix I is a reassessment of the resources in the Nichols report.

*Rocket Science* includes background research, an architectural field reconnaissance, a historical overview, and an assessment of potential Cold War historic properties. The field reconnaissance focused on historic resources with a high probability of being NRHP eligible within the arsenal's Cold War historic context. Department of the Interior and DOD regulations and guidelines regarding historic resources and Cold War properties were used in evaluating the properties for NRHP eligibility.

Part II of this document addresses the methods undertaken in establishing the Cold War historic context for the installation. It discusses guidelines for evaluating NRHP eligibility and includes military guidelines for assessing Cold War historic properties. Part III is a historical overview that focuses on the most important people and activities at Redstone Arsenal during the Cold War. Part IV evaluates the context of the arsenal from

Cold War and Army perspectives. The physical development of the arsenal during the Cold War is included. This section also assesses resources potentially NRHP eligible. The report concludes with recommendations for further historic preservation activities with respect to Cold War properties.



Figure 1. Map of Northeast Alabama Showing Location of Huntsville.

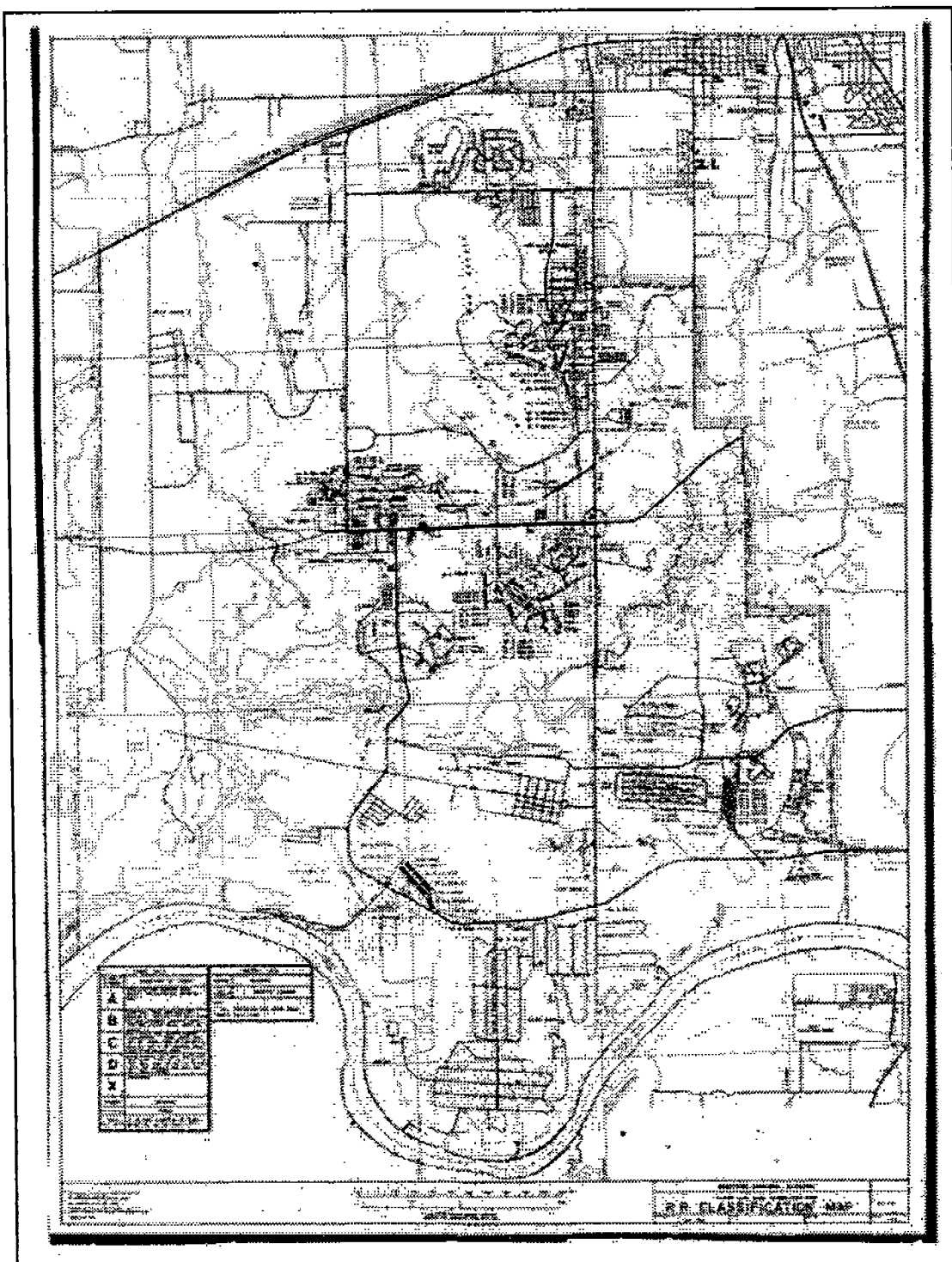


Figure 2. Redstone Arsenal -- Located Southeast of Huntsville, Alabama (Master Plan, Basic Information Map, R R Classification Map, April 1962).

## 2.0 METHODOLOGY

### 2.1 Background Research

Background research for *Rocket Science* was conducted by Historic Resource Assessments (HRA) prior to the initiation of fieldwork for this project. In order to identify known cultural resources at Redstone Arsenal, previous historic building surveys were consulted. These works were *Historic Properties Report: Redstone Arsenal, Alabama with the George C. Marshall Space Flight Center* by David G. Buchanan and John P. Johnson of Building Technology Inc.; *Architectural Assessment of the World War II Military and Civilian Works, U. S. Army Missile Command, Redstone Arsenal, Madison County, Alabama* by Kelly Nolte of Panamerican Consultants, Inc.; and *Architectural and Historic Inventory of Buildings and Structures Dating to the Cold War-Era (1946-1989) at the Redstone Arsenal, Alabama* by Ruth D. Nichols of TRC Mariah Associates, Inc. Records at the National Park Service (NPS) were checked for properties listed on the National Register of Historic Places (NRHP), and staff members at Redstone Arsenal Support Activity (RSA) provided information on existing or pending nominations.

Historical data was collected during this phase of the project from RSA, the History Office of U.S. Army Aviation and Missile Command at Redstone Arsenal, the Marshall Space Flight Center (MSFC), the University of Alabama-Huntsville, and the Huntsville-Madison County Public Library. Government records, newspapers, reports, telephone directories, published histories, maps, photographs, organizational histories and charts, and building plans were among the materials used in completing the historic context.

### 2.2 Field Methods

Prior to the completion of background research, several windshield surveys were undertaken by HRA with the staff of the History Office of U.S. Army Aviation and Missile Command. The surveys served to identify areas containing potential historic properties. The post historians are intimately familiar with the historical significance of the installation. They were consulted throughout the early phases of the project on the location of properties associated with the Cold War and possibly eligible for the NRHP.

As a result of these consultations, several areas were identified for further study. These areas were the subjects of an architectural field reconnaissance during the summer of 1999. The reconnaissance consisted of a pedestrian visit to each area. Photographs were made, field notes were taken, and the condition and integrity of buildings and structures were evaluated at this time. Marcus Whiffen's *American Architecture Since 1780: A Guide to the Styles*, Virginia and Lee McAlester's *A Field Guide to American Houses*,

and John Blumenson's *Identifying American Architecture* were used in analyzing architectural style and type.

## 2.3 NRHP Evaluation Methods

### 2.3.1 Criteria of Evaluation

Individual properties and historic districts identified as being potentially eligible for the NRHP were assessed according to the NRHP Criteria for Evaluation. In order to be considered eligible for the NRHP, cultural resources must possess local, state, or national significance in relation to similar resources or resource types within a specific historic theme, period, and geographic area.<sup>1</sup> Properties less than 50 years of age (including birthplaces and/or graves of historical figures), religious properties, buildings moved from their original locations, commemorative properties, and properties that have gained significance within the last 50 years are usually considered ineligible for the NRHP.<sup>2</sup>

National Register of Historic Places -- Criteria for Evaluation	
Properties are eligible for the National Register of Historic Places if they:	
Criterion A.	Are associated with events that have made a significant contribution to the broad patterns of our history;
Criterion B.	Are associated with the lives of persons significant in our past;
Criterion C.	Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguished entity whose components may lack individual distinction;
Criterion D.	Have yielded, or may be likely to yield, information important in prehistory or history.

A site, building, structure, or object can be placed on the NRHP. A collection of historic resources may comprise a historic district. Such a district contains resources that possess "significant concentration, linkage, or continuity" and are "united historically or aesthetically by plan or physical development."<sup>3</sup> An NRHP historic district may contain resources that might be considered ineligible if evaluated on an individual basis. A historic district must have a character or coherence that differentiates it from adjacent areas as a historic environment.

<sup>1</sup> U.S. Department of the Interior, National Park Service, *National Register Bulletin 15: How To Apply the National Register Criteria for Evaluation* (Washington, D.C.: U.S. Department of the Interior), 1995.

<sup>2</sup> U.S. Department of the Interior Regulations, 36 CFR 60: *National Register of Historic Places*, Section 4.

<sup>3</sup> U.S. Department of the Interior, National Park Service, 1995, p. 5.

### 2.3.2 Resource Integrity

In order to be eligible for the NRHP, resources must exhibit good integrity. Integrity is divided into seven separate qualities: location, design, setting, materials, workmanship, feeling, and association. If these qualities are diminished, and a historic resource no longer retains its historic identity or character, then the resource is not eligible for the NRHP due to loss of integrity. Integrity of historic resources may be described as:

- **Excellent** -- All original construction materials and design remain intact and unchanged.
- **Good** -- The majority of original construction materials remain intact and unchanged except for roofing and other renewable architectural elements.
- **Fair** -- A substantial number of original architectural elements have been altered, such as the installation of aluminum, asbestos, or vinyl siding, the replacement of non-historic doors and windows, and the construction of non-historic additions.
- **Poor** -- Radically altered from its original design by non-historic renovations and/or additions.

### 2.3.3 Criteria Considerations

The Cold War is considered by many historians to have lasted from March 1946, when Winston Churchill made his famous "Iron Curtain" speech, to November 1989, when the Berlin Wall fell. Therefore, eligibility of Cold War resources at Redstone Arsenal was assessed with respect to Criteria Consideration G. This category allows a resource to be included in the NRHP if it has gained significance within the last 50 years. Most Cold War resources must be exceptionally important to be considered NRHP eligible. Criteria Consideration G may be found in Appendix II.

## 2.4 Assessing Cold War Resources

In order to determine which properties at Redstone Arsenal are exceptionally important within the historic context of the Cold War, Department of Defense (DOD) guidelines were used as part of the evaluation. Authorities consulted included *Cold War Property Identification, Evaluation and Management Guidelines* by the Department of the Army (DOA), *Looking Between Trinity and the Wall: Army Materiel Command Cold War Material Culture Within the Continental United States, 1945 – 1989* by Geo-Marine Inc., *A Systemic Study of Air Combat Command Cold War Material Culture, Volume I: Historic Context and Methodology for Assessment* by Mariah Associates, Inc., and *Coming in From the Cold: Military Heritage in the Cold War* by the DOD.

According to the Army's *Cold War Property Identification, Evaluation and Management Guidelines*, which identifies and addresses Cold War properties, a Cold War property is defined as one that "through physical design or association with people or events . . . embodies the mistrust of the Soviet Union and in contrast, promotes American policy, objectives and ideology of the period." In order to be considered a Cold War property, the following criteria that a historic resource must meet is provided:

- 1) Was constructed or used between March 1946 and November 1989 in order to:
  - Meet a specific real or perceived Soviet military threat; or
  - Project force designed to influence Soviet objectives and policies; or
  - Carry out major national objectives and policy toward the Soviet Union; or
  - Affect global opinion of the relationship between the superpowers.
- 2) Through its architectural or engineering design, clearly reflects one or more primary themes of the Cold War period.
- 3) Directly relates to the U.S./Soviet relationship through association with a milestone event of the period.
- 4) Directly relates to the U.S./Soviet relationship through association with the life of an exceptionally significant figure during their period of contribution.
- 5) Not normally considered a Cold War property, but an integral contributing part to a Cold War historic district and fundamental to the understanding of the district as a whole.

The Army defines a Cold War property as having "exceptional significance" when it "exemplifies, through its physical properties, key characteristics of the U.S./Soviet relationship," or "represents milestone events of the Cold War through association," or serves as "the principal source of information essential for understanding U.S./Soviet relations through data derived from its study." Additionally, "it is outstanding in relation to other Cold War properties in scale, quantity, and comparison."<sup>4</sup>

Army guidelines differentiate between Cold War properties and Cold War era properties. Although existing during the Cold War era, Cold War era properties do not reflect through design or association the U.S./Soviet relationship in a direct manner. Operations buildings used for administration, infrastructure, housing, and recreation are typical of the Cold War era properties that were not evaluated as part of this report.

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<sup>4</sup> U.S. Department of the Army, Director of Environmental Programs, *Cold War Property Identification, Evaluation and Management Guidelines* (Washington, D.C.: Headquarters, Department of the Army, 1997), pp. 2-3.

Air Force policy also dictates that base support structures should not be NRHP eligible under Criteria Consideration G. According to *Coming in From the Cold*, "Our [U.S. Air Force's] reading of 'exceptional significance' excludes many real property assets which are typically the subject of Section 106 consultations on older, pre-WWII bases, e.g., family housing (Capehart, Wherry, etc.), BOQs, base exchanges, administrative buildings, garages, and motor pools, maintenance shops, sewage treatment plants, etc. The Air Force will instead focus specifically on operational missions and equipment of unmistakable national importance and a *direct*, not merely temporal, Cold War relationship."<sup>5</sup>

Six Army-specific Cold War themes are provided in the Army guidelines:

1. Mission Focus--New missions for the Army were created during the Cold War. Continental air defense, adaptation of conventional forces for the use of tactical nuclear weapons, and the defense of Europe as part of the North Atlantic Treaty Organization (NATO) were new challenges for the Army.
2. Survival--The Army helped prepare the U.S. for total war by formulating contingency plans, "hardening" key strategic facilities, and constructing simulators designed to train personnel in surviving a nuclear attack.
3. Technology--The Army participated in the development of high-technology solutions to offset Soviet advantages in men and material. Research, development, production and stockpiling of exotic weapons and weapons systems occurred during the Cold War.
4. Militarizing of Space--The Army was very involved in the Space Race with the Soviets throughout the 1950s. Often conducted under the guise of space exploration, research and development of missiles and satellites as potential weapons and intelligence-gathering devices was a major activity of the Army.
5. Extraordinary Measures--Traditional ethical and moral boundaries were challenged as the Army sought new means and methods of warfare. Energy-directed weapons, human medical experimentation, psychological operations, and weapons of mass destruction are examples of this. The theme of extraordinary measures embodies the moral debate over methods used rather than focusing on the actual product.
6. Secrecy--The theme of secrecy relates to the extraordinarily high levels of secrecy used during the Cold War. These levels would not normally be

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<sup>5</sup> U.S. Department of the Air Force, Center for Air Force History, *Coming in From the Cold: Military Heritage in the Cold War* (Washington, D.C.: U.S. Department of Defense, 1994), p. 69.



tolerated in an open society, but were rationalized due to national security concerns. Examples include such properties as underground war rooms.

These guidelines also provide a test for determining if Army properties should be considered exceptionally important. The property should (1) embody one of above six themes, (2) be worthy of description using such adjectives as outstanding, notable, extraordinary, rare, superior, and uncommon, (3) contain information absolutely vital to understanding U.S./Soviet relations during the Cold War, (4) display the highest level of importance attainable within its historic context when compared to similar properties, and (5) have national or global significance.<sup>6</sup>

*A Systemic Study of Air Combat Command Cold War Material Culture, Volume I: Historic Context and Methodology for Assessment* also provides a basis for evaluating exceptionally important Cold War properties. In this document Joseph Murphey writes:

The Cold War was a confrontation between nations with diametrically opposed ideologies who battled for control of western Europe and global geo-political influence. Fueled by mutual fear and mistrust, conflict arose ideologically, politically, socially, militarily, scientifically, and economically in a didactic crusade presented in dichotomous terms (e.g., good/evil, free/oppressed). For a military Cold War property to be considered exceptionally significant, it must vividly illustrate a key aspect of the progression from ideology to policy to military endeavor and it must do so in a direct, clear fundamental manner obvious to a general audience with minimal understanding of the Cold War context.

Cold War properties can possess symbolic, technological, and social values of exceptional significance. However, significance for military Cold War properties primarily centers around the protection of the American citizenry through a technological imperative arising from fear and mistrust of the Soviet Union. Offensive and defensive weapons research, design, testing, and deployment were the diplomatic and political weapons used to fight the Cold War, regardless of actual military strength of the weapon or system. This technological imperative was significant for its symbolic value as well as its engineering achievements, having social impacts that echoed throughout American life.<sup>7</sup>

The rule of thumb for assigning exceptional importance, Murphey concludes, "is to limit that category to those resources that graphically convey the ideological differences in U.S.-Soviet relations in an obvious manner."

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<sup>6</sup> U.S. Department of the Army, Director of Environmental Programs, pp. 44-45.

<sup>7</sup> Karen Lewis et al., *A Systemic Study of Air Combat Command Cold War Material Culture, Volume I: Historic Context and Methodology for Assessment* (Austin, Tex.: Mariah Associates, Inc., 1995), pp. 10-11.

He continues on and suggests that a resource should convey one or more of the following themes which illustrate the ideological differences between the powers:

- The bipolar battle of opposing economic and political ideologies present in the struggle for geo-political power in western Europe and the containment of Soviet expansionism and influence in the Third World
- The massive American investment in research and development of technology to battle real and perceived strategic military challenges with the Soviet Union (e.g., the arms race, the bomber gap, the missile gap), for political leverage (i.e., for use in treaties), and for the psychological comfort of the nation's citizenry, forever changing the economic, geographic, and social landscape of the nation (e.g., the military-industrial complex, the interstate highway system, and the computer)
- The deployment of offensive/defensive systems and development of readiness programs for protection against an attack by the Soviet Union and to ensure the survivability of military installations and the general civilian population
- The omnipresent potential to use nuclear devices, keeping the Cold War cold through such concepts as mutually assured destruction.<sup>8</sup>

Murphey also ranks Cold War resources in order of importance in *A Systemic Study of Air Combat Command Cold War Material Culture*:

1. **Research and Development.** These properties reveal the very nature of the Cold War that produced the vast military-industrial complex devoted to technological solutions to an ideological confrontation. These properties directly lead to breakthrough developments resulting in technological hardware that could affect the strategic balance of power.
2. **C3I Complexes and Systems.** Maintaining command, control, communications, and intelligence (C3I) was the key to survivability before, during, and after a nuclear first strike. These properties thereby reveal the extent of the mistrust and suspicion of Soviet intentions.
3. **Strategic Weapon Systems and Support.** Planned and deployed weapons systems and their direct support structures specifically designed to combat Soviet forces were the bargaining chips of arms control negotiations and formed the basis for the balance of power.

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<sup>8</sup> Karen Lewis et al., p. 123.

4. **Strategic Material Production Facilities.** The vast infrastructure of industrial facilities was used to produce the high-technology hardware which gave credence to U.S. Cold War resolve.
5. **Operational Support Facilities.** Depots, storage warehouses, maintenance docks and hangers, etc., provided operational mission support and movement of men and materiel.
6. **Training Facilities.** These properties were used to train personnel for Cold War missions.
7. **Social Support Facilities.** Dorms, theaters, chapels, exchanges, etc., provided necessary support services for personnel.<sup>9</sup>

Another source used for this report was *Looking Between Trinity and the Wall: Army Materiel Command Cold War Material Culture Within the Continental United States, 1945 – 1989* by Steve Gaither and Duane Peter of Geo-Marine, Inc. This work provides a national historic context for properties within the inventory of U.S. Army Materiel Command (AMC) at the end of the Cold War. It is particularly relevant because the resources evaluated at Redstone Arsenal are current or former AMC facilities or facilities operated by predecessor organizations. Prior to the creation of AMC the Army had seven technical services: Ordnance Department, Chemical Corps, Signal Corps, Transportation Corps, Quartermaster Corps, Corps of Engineers, and the Surgeon General. These technical services were combined to form AMC in 1962.

The objective of *Looking Between Trinity and the Wall* was to investigate and document the themes and events that brought about the construction, modification, and use of buildings and structures by AMC and its predecessor organizations throughout the Cold War period. It divides AMC facilities into 10 categories: Storage, Production, Research and Design, Communications, Intelligence and Surveillance, Test and Evaluation, Training, Troop and Employee Support, Utility and Basic Infrastructure, and Weapon Systems and Platforms. The themes and events are presented in a manner by which the significance of associated properties can be assessed. Particular emphasis is placed on the material culture of the research and development, testing, and industrial production programs.

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<sup>9</sup> Ibid, p. 130.

## 3.0 HISTORICAL OVERVIEW

### 3.1 The Origins of Huntsville: 1805-1940

Huntsville was a small southern town with a population of 13,050 when the U.S. Army selected it as the site for a new arsenal in early 1941. Huntsville is located in northeast Alabama, in Madison County, which was created in 1808. The town was founded near the Tennessee River in 1810 as Twickenham. The name was changed to Huntsville in 1811. It was renamed for John Hunt, who originally settled here in 1805.

The town quickly grew, and in 1812 the *Madison Gazette*, believed to be the second newspaper in Alabama Territory, was established. Huntsville was chosen as the meeting place for the convention that drafted the Alabama State Constitution. Following the admittance of Alabama as the 22nd state on December 14, 1819, Huntsville served temporarily as the first state capitol. It was the site of the first governor's inauguration and the first session of the state legislature.

Huntsville became a regional center for education, culture, agriculture, and industry. The first bank in the state of Alabama was established in Huntsville. The growth of cotton fueled the town's prosperity. It was a transportation hub, served by river barges, stagecoaches, and, later, trains of the Memphis and Charleston Railroad. Huntsville was a target for Union troops during the War Between the States and was occupied by the Yankees in 1862.

Huntsville, as the rest of the South, was devastated economically by the war. The investment of northern capital in cotton production during Reconstruction, however, led to industrial development in the late nineteenth century. A boom in mill construction around 1900 resulted in the establishment of Huntsville as a thriving cotton textile center. The early twentieth century also brought the construction of hardwood mills and plant nurseries to this primarily agricultural area. The establishment of the cotton gin and iron industries during this period resulted in the tremendous growth of Huntsville's textile industry.<sup>10</sup>

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<sup>10</sup> Kelly Nolte, *Architectural Assessment of the World War II Military and Civilian Works, U.S. Army Missile Command, Redstone Arsenal, Madison County, Alabama* (Tuscaloosa, Ala.: Panamerican Consultants, Inc., 1996), p. 13.

### 3.2 World War II: 1941-1945

As part of a nationwide mobilization effort, ground was broken for the Huntsville Arsenal in August 1941. At that time the Edgewood Arsenal, adjacent to Aberdeen Proving Grounds, Maryland, was the U.S. Army Chemical Warfare Service's only manufacturing facility. The new Army post in northern Alabama was intended to be an extension of Edgewood for the manufacture of toxic agents, smoke, and incendiary materiel. Huntsville was selected because of the availability of rail and river transportation and easy access to Tennessee Valley Authority (TVA) electric power. It was one of three chemical production facilities, including Pine Bluff Arsenal in Arkansas and Rocky Mountain Arsenal in Colorado, constructed by the Chemical Warfare Service for use during World War II.<sup>11</sup>

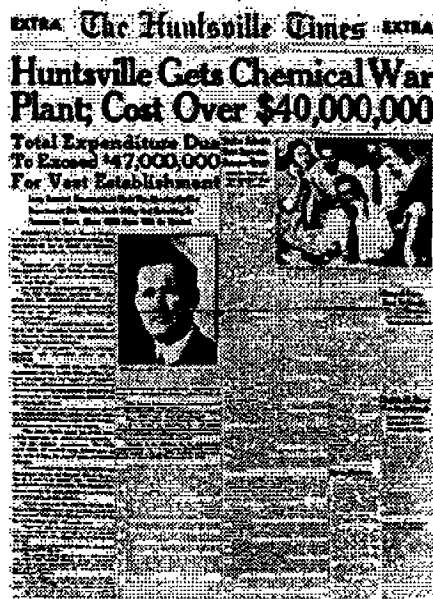


Figure 3. The *Huntsville Times* for July 3, 1941.



Figure 4. Major Carroll D. Hudson, first commander of Redstone Ordnance Plant, breaks ground in a cotton field, October 25, 1941.

Thousands of acres of cotton fields and pastureland southeast of Huntsville were converted to industrial use. The new chemical-ammunition-manufacturing center consisted of three installations: the Huntsville Arsenal, the Redstone Ordnance Plant, and the Huntsville Chemical Warfare Depot. The Chemical Warfare Service administered the Huntsville Arsenal and Huntsville Chemical Warfare Depot, while the U.S. Army Ordnance Department was in charge of the Redstone Ordnance Plant. The

<sup>11</sup> Steve Gaither and Duane Peter, *Looking Between Trinity and the Wall: Army Materiel Command Cold War Material Culture Within the Continental United States, 1945 – 1989* (Plano, TX: Geo-Marine, Inc., 1997), p. 41.

War Department purchased 32,690 acres from local landowners for these installations in 1941 and early 1942. The TVA and U.S. Department of the Interior permitted the War Department to use approximately 6,990 acres of adjacent land.

Construction was a massive undertaking. The Huntsville Arsenal consisted of around 22,890 acres and included manufacturing plants, chemical-loading plants, storage facilities, laboratories, shop buildings, offices, housing, and a hospital. The Huntsville Chemical Warfare Depot occupied approximately 7,600 acres of Huntsville Arsenal land. It covered 12 square miles and was divided into three areas: the toxic gas yard, the munitions branch, and warehouses. The Redstone Ordnance Plant, adjacent to the Huntsville Arsenal, occupied around 9,800 acres. It contained ammunition assembly lines and facilities for storage, administration, housing, and utilities. It was also necessary to build roads, railroad lines, and other services to support the installations, which occupied a combined area of 39,680 acres.

Products manufactured at the Huntsville Arsenal included mustard gas, phosgene, lewisite, white phosphorus, tear gas, incendiaries, and colored smoke. Load lines packaged finished products into 500- or 1000-pound bombs, artillery shells, hand grenades, or igniter tubes. Redstone Ordnance Plant completed the ordnance loaded at the Huntsville Arsenal by installing fuses, boosters, propellant charges, or primers. Assembled ordnance was then sent to the Huntsville Chemical Warfare Depot. The depot received, stored, and shipped the materiel.



Figure 5. Employees of Redstone Ordnance Plant inspect chemical ammunition during World War II.

The Huntsville Arsenal was in full operation by the end of 1942 and continued to produce white phosphorus as late as August 1945. Following the war, the Army ceased all production and designated the Huntsville Arsenal as a storage center for surplus war materiel. Some of the facilities were leased to private companies, such as the Solvay Process Division of the Allied Chemical and Dye Corporation and the Keller Motors Corporation.

1943 the depot consisted of seven warehouses, 370 storage igloos, 55 aboveground magazines, several outdoor storage areas, twelve miles of railroad tracks, and dock facilities on the Tennessee River. It was renamed Gulf Chemical Warfare Depot in August 1943.

The Huntsville Chemical Warfare Depot was activated in March 1942. By early

Redstone Ordnance Plant was activated February 5, 1942. Four production lines had been completed by August 1942, and by January 1943 a fifth production line was ready for operation. Redstone Ordnance Plant underwent an organizational upgrade and became Redstone Arsenal in February 1943. In January 1945 a \$5.5 million expansion program was announced. All five production lines were altered in order to increase output. With the cessation of hostilities, ammunition production ceased on August 17, 1945. Production lines were decontaminated and placed on standby status.

### 3.3 Redstone Arsenal in the Cold War Era: 1946-1989

#### 3.3.1 The Emergence of *Rocket City U.S.A.*: 1946-1955

##### *A New Center for U.S. Army Missile R&D*

With the conclusion of World War II, most activity at the sprawling industrial complex southeast of Huntsville ground to a halt. In August 1946 the name of the Gulf Chemical Warfare Depot was changed to Gulf Chemical Depot. It ceased to be a separate facility and was transferred to the Huntsville Arsenal in January 1947. Renovation and salvage of materiel continued at Redstone Arsenal until February 1947, when it was placed on standby status. The Army placed Huntsville Arsenal on standby status in 1948 and then advertised the property for sale in 1949.

Things were not quiet for long, however, because the U.S. Army Chief of Ordnance was looking for a new home for the Army's rocket scientists. He reactivated Redstone Arsenal as the research and development (R&D) center for the Ordnance Department's guided missile program in June 1949. In July the Army announced that the Ordnance Research and Development Division Sub-Office (Rocket) at Fort Bliss, Texas, would be relocated to Huntsville.

The U.S. government contracted with the Rohm and Haas Company of Philadelphia, Pennsylvania, and the Thiokol Corporation of Trenton, New Jersey, to conduct research on solid propellants for rockets in 1949. These firms constructed new facilities and utilized existing ones in the Redstone Arsenal area. Rohm and Haas occupied a 230-acre load line, which had been used for loading bombs and artillery shells with chemical agents, and converted it for propellant development in late 1949. Administration, lab experimentation, engineering, motor loading, testing, and storage occurred in what is now known as the 7500 Area. Thiokol occupied an old tetryl pelleting line, which had been

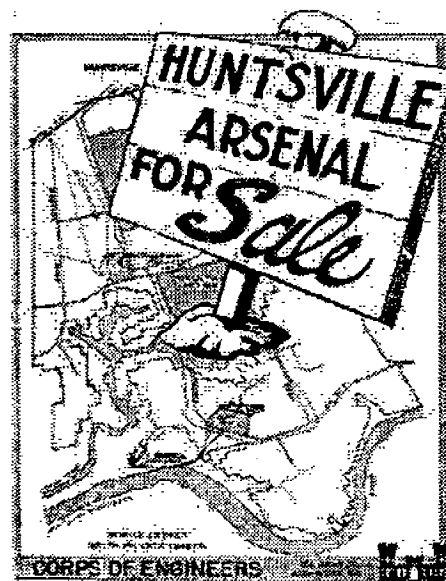


Figure 6. Advertisement for sale of Huntsville Arsenal.

used to manufacture TNT, in July 1950. Thiokol engaged in propellant mixing and the loading, casting, and curing of motors. Static testing occurred elsewhere.<sup>12</sup>

Ground was broken for the \$1.5 million Josiah C. Gorgas Laboratory on March 3, 1951. Dedicated on March 15, 1952, the laboratory (now known as Building 7770) was built for Rohm and Haas. Activities at this facility were in the field of basic research in solid propellants for rocket motors, performance characteristics, motor development, and engineering analysis of test data.<sup>13</sup>

As activities in the Redstone Arsenal area increased, it became apparent that more land was needed. In response to this need, Huntsville Arsenal, which was still advertised for sale, was taken off the real estate market, entirely deactivated, and transferred from the Chemical Warfare Service to the Ordnance Department. These facilities were reactivated by the Ordnance Department and consolidated into Redstone Arsenal.

With room to grow, post facilities would increase in size and importance. As Redstone Arsenal became the nerve center for Army missile R&D, many more firms and government personnel moved to Huntsville. As the population grew by leaps and bounds, this small southern town would become known as "Rocket City, U.S.A." During the next decade the population of Huntsville would increase from approximately 16,000 in 1950 to 65,000 in 1955 to about 72,000 in 1960, a growth of 350%.<sup>14</sup> By 1970 the town had grown to 140,000 inhabitants.<sup>15</sup>

Dr. Wernher von Braun and approximately 120 German rocket scientists arrived in Huntsville from Fort Bliss, Texas, in April 1950. These new Alabama residents formed the core of the Ordnance Guided Missile Center, which was located in the former Huntsville Arsenal area. The arrival of the German rocket scientists in Huntsville was the ultimate result of *Operation Paperclip*. *Operation Paperclip* was a top-secret effort by the United States, in the closing days of World War II, to hire the brightest scientific minds in Germany. The effort was two fold: U.S. government officials wanted these men working for the Department of Defense – but, most importantly, they did not want them working for the Soviet Union.

### ***Operation Paperclip***

Although the United States was allied with the Soviet Union against Nazi Germany, U.S.-U.S.S.R. relations began to erode as World War II drew to a close. Both sides knew that their political and ideological differences, coupled with their emergence from the war as two world superpowers, would most likely make them adversaries in the next world war. *Operation Paperclip* may be accurately described as the first skirmish of the Cold War.

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<sup>12</sup> J.W. Wiggins, *The Earliest Large Solid Rocket Motor: The Hermes* (Bristol, Pa.: Thiokol Chemical Corporation, 1972), p. B-1.

<sup>13</sup> "Mission Accomplished: Unique Rohm & Haas Operation Whiles Away Last Days Here," *Huntsville Times*, 3 January 1971.

<sup>14</sup> Helen Brents Joiner and Elizabeth C. Jolliff, *The Redstone Arsenal Complex in its Second Decade: 1950-1960* (Redstone Arsenal, Ala.: U.S. Army Missile Command, Historical Division, 1969).

<sup>15</sup> Frederick I. Ordway, III, and Mitchell R. Sharpe, *The Rocket Team: From the V-2 to the Saturn Moon Rocket* (New York: Thomas Y. Crowell, Publishers, 1979), p.363.



As Anglo-American and Soviet forces rolled into Germany in March 1945, both sides began frantically searching for the scientists who had invented the powerful secret weapons of the German *Wehrmacht* and *Luftwaffe*. Rocket aircraft, jet fighters and bombers, and ballistic missiles were just some of the operational weapons found in the German arsenal – and not found in the arsenals of the Allies.

Colonel Gervais Trichel, chief of the U.S. Army Ordnance Department's Rocket Branch, was particularly impressed with the Third Reich's successful V-2 missile. Several months before the war ended, and before *Operation Paperclip* became government policy, Trichel sought the capture of German long-range missiles, the scientists who created them, and the technical documents relating to their construction.<sup>16</sup> Trichel dispatched Major Robert B. Staver, a rocket engineer on his staff in Washington, to the Ordnance Technical Division in London in February 1945. Staver spent many hours reviewing British intelligence reports. He compiled lists of hundreds of German installations involved in rocket and jet research and the technical experts working at these sites. He began ranking, in order of importance, thousands of Germans who could provide significant military research information or who could later pose a threat if captured by the Soviets. At the top of his inventory, which was given the code name *Black List*, Staver placed the name of Wernher von Braun.<sup>17</sup>

In March 1945, Trichel contacted Colonel Holger N. "Ludy" Toftoy, chief of Ordnance Technical Intelligence in Europe, and requested that 100 operational V-2s be captured and sent to the U.S. as early as possible. Reports indicated that the large, underground V-2 production plant, *Mittelwerk*, was located near the town of Nordhausen in the Hartz Mountain. Toftoy acted quickly and decisively when he learned of the capture of

*Mittelwerk*, outside the village of Niedersachswerfen, on April 11. In the absence of orders from the Pentagon, Toftoy created Special Mission V-2.

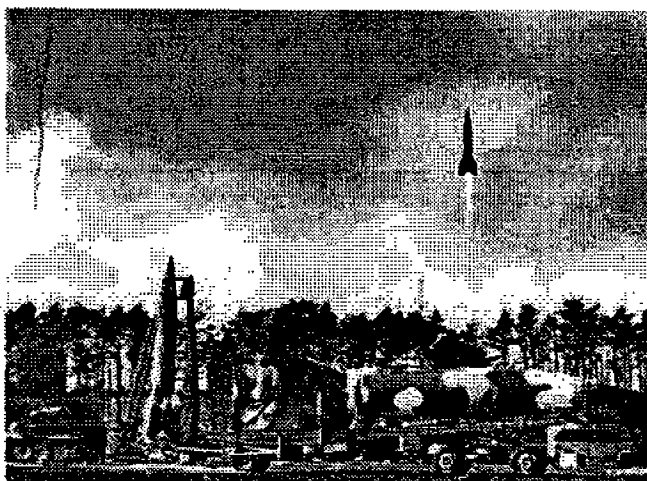


Figure 7. Launch of V-2 rocket at Peenemünde, Germany, during World War II. Note V-2s in foreground with camouflage paint scheme.

As part of Special Mission V-2, Major James P. Hamill was responsible for coordinating the shipments of the V-2s from Nordhausen. Hamill had a huge task ahead of him. Because V-2s were transported to their launch sites shortly after construction, there were no completed V-2s available in the tunnels of *Mittelwerk*. A trainload of approximately 50 completed V-2s

<sup>16</sup> William B. Breuer, *Race to the Moon: America's Duel With the Soviets* (Westport, Conn.: Praeger Publishers, 1993), p. 60.

<sup>17</sup> Ordway and Sharpe, p. 278.

was found in the rail yard at Nordhausen, which had been heavily hit by Allied bombers. With no intact V-2s available, it was necessary for Hamill to collect and ship the components of 100 V-2 missiles.

Hamill's problems were compounded by the fact that *Mittelwerk* was located in what was to be the Soviet zone of occupation. At the February 3, 1945, meeting at Yalta, the Allies had agreed on a plan to divide Germany into four occupation zones. Because American forces had driven deep into what would be the Soviet area, it would be necessary for the U.S. Army to withdraw from large portions of eastern Germany. Nordhausen and Niedersachswerfen were located in the Soviet area, so American troops would have to be withdrawn. In November 1944 the European Advisory Commission, which consisted of Allied representatives, had agreed that resources found by the conquering Allies would be left in place until the Allied personnel assigned to that occupying zone arrived to take possession of them. Factories, research institutions, plans, drawings, and inventions were to remain intact, in place, and in good condition. Removal of the V-2s from the Soviet zone, therefore, was an American violation of this agreement.

Toftoy, however, was not concerned with political deliberations at Yalta or any diplomatic agreements. Several Army officers had expressed concern over the fact that some very advanced weaponry might fall into the hands of the Soviet Union. In what may have been one of the first shots of the Cold War, Toftoy told Hamill that the "high-level agreement among the Allies is that nothing is to be moved out of the Russian zone . . . however, unofficially, I'm telling you to see that those 100 V-2s get to Antwerp . . . get all the materials you can without making it too obvious that we've looted the place."<sup>18</sup> As Ordnance Technical Intelligence staff collected, packed, and shipped components of the V-2s, they recognized the rocket as "a scientific milestone in man's technological advancement."<sup>19</sup>

Russian troops were expected to occupy Nordhausen and Niedersachswerfen on June 1, so Hamill was up against a short deadline. The Army Transportation Corps provided more obstacles for Hamill. They did not want to get involved in an operation that could cause an international incident among the Allies – a hot war before the Cold War even began. It was necessary, therefore, for Ordnance personnel to, in the words of Hamill, "run its own railroad during this period."<sup>20</sup> The covert removal of the V-2 components to Antwerp required 341 railroad cars. The parts were then loaded aboard 16 Liberty ships for the trip across the Atlantic Ocean. Requisitioning the manpower and equipment to transport the missiles was very difficult. The last shipment of missile parts left Nordhausen on the evening of May 31, six hours before the expected arrival of Soviet occupation troops.

While Hamill worked feverishly to identify and remove V-2 components, Staver located and extricated 14 tons of V-2 reports and drawings that had been buried in an abandoned

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<sup>18</sup> Breuer, pp. 85-86.

<sup>19</sup> Major General H.N. Toftoy and Colonel J.P. Hamill, "Historical Summary on the Von Braun Missile Team," 29 September 1959, Saturn History Collection, University of Alabama-Huntsville, p.1.

<sup>20</sup> Ordway and Sharpe, p. 279.

mineshaft near Dornten. The papers were in the British Zone, so it was necessary for Ordnance officers to deceive a British colonel in order to remove the papers. Truckloads of documents were removed on the morning of May 28, less than four hours before British troops deployed into the area and set up roadblocks.

Staver also searched for German scientists and technicians. One large group was found in the Thuringia region, where Nordhausen is located, while another group surrendered to American troops near Garmisch-Partenkirchen. Staver managed to round up 400 scientists and recommended that the top 100 be evacuated immediately to America. He wrote, "the thinking of the scientific directors of this group is 25 years ahead of the U.S."<sup>21</sup>

Interrogation facilities were established for German scientists in Garmisch-Partenkirchen, in Bavaria near the Austrian border. In June 1945 Toftoy was selected by the Chief of Ordnance to develop the Army's guided missile program. The following month he traveled to Germany to participate in the interviews, which lasted throughout the summer. Toftoy noted that "experienced technical people only were selected with a view to the eventual establishment of a fully integrated team of top scientists and engineers in each of the fields required for the development of a complex guided missile system." His plan was to build a rocket team that consisted of the best mechanical engineers, electrical engineers, chemists, aerodynamic experts, fuel specialists, and physicists. Toftoy selected "127 of the bona fide experts – the creative scientists and engineers – as the original team for employment by the Army in the U.S." His best hire from "the world's only experienced supersonic ballistic missile team," as history would prove, was von Braun.<sup>22</sup>

In the meantime, the Russians were desperate to get rocket scientists. Broadcasts were made daily from Radio Leipzig in an effort to entice von Braun's team to join the Russians. A price was even put on the heads of von Braun and Dr. Ernst Steinhoff by Soviet authorities. Von Braun, however, was not interested in Soviet offers. In February 1945 he had led his staff in the evacuation of the *Wehrmacht* missile research facility at Peenemunde as the Soviet Red Army approached. He and over 3000 scientists and technicians and their families



Figure 8. Von Braun, with arm in cast, following his surrender to the U.S. Army at the close of World War II.

<sup>21</sup> Ibid, p. 284.

<sup>22</sup> Toftoy and Hamill, pp. 3-4.

relocated from eastern to central Germany, near the *Mittelwerk* plant. As the war drew to a close, von Braun and some of his top men traveled to Bavaria, where they hoped to surrender to the U.S. Army. His goal was to get to America, where he believed his dream of space travel could be realized. According to von Braun, "we were interested in continuing our work in the United States, not just being squeezed like a lemon and then discarded."<sup>23</sup>

The acquisition of German scientific talent finally became official government policy when General George C. Marshall approved a Joint Chiefs of Staff secret memorandum on July 6, 1945. The memorandum allowed for a limited number of German scientists to be brought to America "for temporary military exploitation, particularly those who will assist in shortening the Japanese war."<sup>24</sup> The plan called for the transportation of 350 technicians, including 100 rocket scientists for Toftoy, to America for six months. The scientists were to be paid modest wages, and at the end of the contract it could be renewed for another six months. Secretary of State Edward R. Stettinius, Jr., approved the plan, which was originally named *Operation Overcast* on July 19, 1945.

The defeat of Japan, within weeks of the plan's approval, meant that the purpose of *Operation Overcast* no longer existed. With the Cold War looming on the horizon, however, the U.S. wanted to make sure it had a technical edge over the U.S.S.R. According to Breuer, "America in a volatile postwar world was far from secure, however, and the haunting specter of a powerful Soviet Union, armed with long-range missiles developed by German scientists, resulted in a high-level decision to continue Overcast."<sup>25</sup>

It was obvious to some U.S. government officials that the Germans were vital to national security. Secretary of State James F. Byrnes and Secretary of War Robert Patterson proposed long-term employment and eventual American citizenship for the German scientists in February 1946. Under this policy the total number of German technicians and scientists to be recruited was increased to 1000. At that time there were already 270 scientists in the United States, including 118 of von Braun's team at Fort Bliss and 62 at Wright Air Force Base in Ohio.

U.S. Navy Captain Bosquet Wey was in charge of the Joint Intelligence Objectives Agency that administered *Operation Overcast*. He was concerned that many scientists would return to Germany when their contracts expired. Wey wanted them to quickly gain American citizenship so they would stay in the United States, otherwise, he wrote, "it's a lead-pipe cinch that the Russians will grab them."<sup>26</sup>

*Operation Overcast* was renamed *Operation Paperclip* in March 1946. The name change was necessary for security purposes. The name of the secret project had been leaked in Landshut, located outside Munich, where the U.S. was caring for dependents of the German scientists. The new name was coined because American recruiters fastened

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<sup>23</sup> Ordway and Shupe, p. 274.

<sup>24</sup> Breuer, p. 100.

<sup>25</sup> Ibid, p. 103.

<sup>26</sup> Ibid, p. 123.

paperclips to the files of German scientists who were selected to come to the America.<sup>27</sup> It was vital that *Operation Paperclip* be kept a secret. Many American's would have been outraged to know that "enemy scientists" were being hired to work in America. Also, according to Breuer, "what the War Department could not reveal was that the United States and Russia, the only nations to emerge from World War II as superpowers, were embroiled in a hectic no-holds-barred battle for missile and technology superiority."<sup>28</sup>

*Operation Paperclip*, which officially ended September 30, 1947, was vital to Department of Defense R&D efforts during the Cold War. As a result, 457 German scientists, technicians, and engineers and 453 of their dependents were brought to America. Many of them, including General Walter Dornberger, von Braun's World War II commanding officer, were at what is now Wright-Patterson Air Force Base. These 209 scientists worked on a variety of projects, some of which involved jet-aircraft development, aerodynamics, airplane structures, helicopters, in-flight refueling, and a gun-sight for night fighters. A German-designed wind tunnel, which operated at Mach 8, was ten years ahead of the best American design. Other *Operation Paperclip* scientists worked with the U.S. Army Signal Corps in improving microwave techniques, generators, and equipment design.

According to Breuer, "in the eyes of the Pentagon, these 'wards' had become even more crucial to national defense, for the Cold War between the West and the Soviet Union and its allies had grown more intense and threatened to erupt in a hot shooting war."<sup>29</sup> The *Operation Paperclip* scientists made tremendous contributions to the development of the American military. The U.S. Air Force claimed millions of dollars and almost ten years of R&D were saved by the project. In 1949 the Navy stated, "it is probable that no program has ever paid more rich dividends. It is not only the direct savings in time and money . . . it is also the acquisition for this country of some of the finest brains in the world—invaluable additions to the nation's resources."<sup>30</sup>

Breuer writes that the War Department justified *Operation Paperclip* by acknowledging "not only had the 118 rocket experts at Fort Bliss saved up to ten years in U.S. research by showing American scientists blind alleys to be avoided and fields that should not be explored, but the use of the Germans' knowledge and experience saved at least \$75 million in missile research."<sup>31</sup> The acquisition of German rocket scientists, missile components, and scientific documents was extremely critical due to the fact that the U.S. lagged so far behind in missile R&D. In regards to the Cold War Nuclear Arms Race, if the Russians had gotten von Braun and his men it could have been disastrous for America.

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<sup>27</sup> Frederick I. Ordway, III, and Wernher von Braun, *The Rocket's Red Glare* (Garden City, N.Y.: Anchor Press/Doubleday, 1976), p. 163.

<sup>28</sup> Breuer, p. 121.

<sup>29</sup> Ibid, p. 123.

<sup>30</sup> Ordway and Sharpe, p. 362.

<sup>31</sup> Breuer, p. 121.

*Operation Paperclip* would have a tremendous impact on the Space Race between the U.S. and Soviet Union during the 1950s and 1960s. With regard to America's triumphant journey to the moon, Breuer notes

Uncle Sam's colossal achievement might never have happened had it not been for the ingenuity and resourcefulness of the handful of young American Army officers and scientists who, acting largely on their own volition, conceived and implemented Operation Overcast at the conclusion of World War II in Europe. Had these Army officers and scientists, most of whom were in their late 20s and early 30s, failed in their mission, it may well have been the flag of Communist Russia planted on the moon instead of the Stars and Stripes of free enterprise America."<sup>32</sup>

#### ***German Rocket Scientists in America***

After being hired by the U.S. Army, von Braun and his *Operation Paperclip* colleagues were put to work immediately. Hamill and the Germans were first assigned to Fort Bliss,

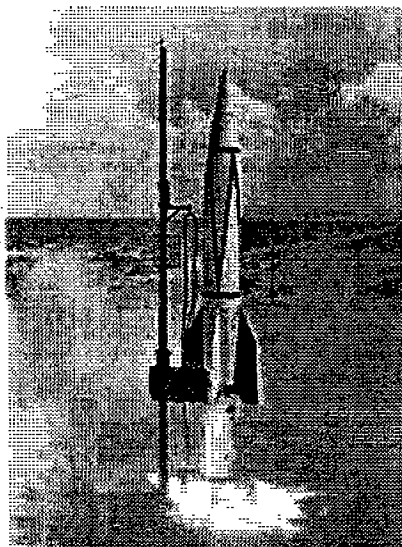


Figure 9. Launch of V-2 at White Sands Proving Grounds.

near El Paso, and the White Sands Proving Ground. They opened shop as Ordnance Research and Development Sub-Office (Rocket), which the Ordnance Department activated on October 3, 1945. With five-year contracts from the United States in hand, their initial job at White Sands was to serve as consultants to industry and research groups engaged in guided missile research. They also assisted in the assembly, checkout, and launching of V-2s, which had arrived from Germany in August. Some of the scientists conducted research and proposed new guided missile programs. Four of the team members worked on the LOKI project, which was based on the German design for the anti-aircraft rocket TAIFUN. The first

static test of a V-2 in America occurred at White Sands on March 14, 1946. On June 28 a V-2 rocket, fully instrumented for high-altitude research, was launched to a height of 67 miles.

While at White Sands Proving Ground, von Braun's team continued to maintain its old dream of space travel. Their experiments at White Sands brought them one step closer.

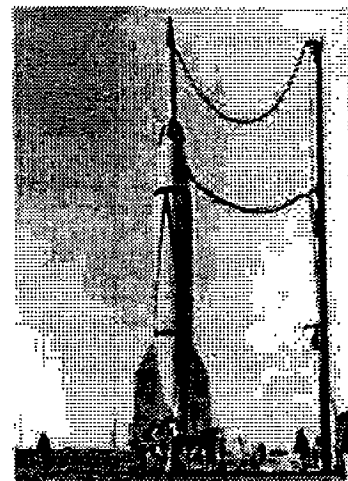


Figure 10. The BUMPER, photographed on February 23, 1949.

<sup>32</sup> Ibid, p. 196.

One of their projects involved the BUMPER, the first two-stage American missile, which had a V-2 first stage and a WAC CORPORAL second stage. A BUMPER launched on February 24, 1949, set an altitude record of 244 miles, achieving the first penetration of space. According to Ordway and Sharpe, "such experiments provided much-needed data for the design of multi-stage rockets."<sup>33</sup>

#### *The New Missions of Redstone Arsenal*

Although the Germans had some notable achievements in the deserts of New Mexico, their greatest work would be done in the hills of north Alabama. When the von Braun team arrived in Huntsville in 1950, Redstone Arsenal had a new set of missions. The arsenal's initial mission, upon reactivation, pertained to rocket-related R&D. The Ordnance Rocket Center conducted R&D and testing of free-flight rockets, jet-assisted take-off engines (JATO), and solid propellant fuels. Solid-propellant rocket R&D, for more conventional forms of Army weaponry such as anti-tank or anti-aircraft missiles, took place in the old Redstone Ordnance Plant area. The Josiah Gorgas Laboratory, a \$1 million research facility for the development of solid propellants, was completed in this area in 1952.

Redstone also administered and supervised R&D contracts, supervised and coordinated Ordnance rocket programs, provided research on all scientific and technological progress in the rocket field, and served as the center of technical expertise on rockets for the Ordnance Department. R&D at the arsenal would later be expanded to include anti-aircraft missiles, rocket launchers, aerial tow targets, aerial target drones, liquid propellant fuels, and liquid oxygen.

As in World War II, Redstone functioned as a reserve depot, the mission of which included the receipt, storage, maintenance, stock control, and issue of Ordnance supplies. The arsenal was also assigned various manufacturing, industrial, field service, and support missions in the 1950s. The manufacturing mission involved the renovation, demilitarization, and maintenance of chemical ammunition and components, elimination of hazardous or unserviceable ammunition, and decontamination of equipment. In 1951 the arsenal became responsible for maintaining pilot production lines for the manufacture and assembly of components for rockets and guided missiles. As a result of U.S. involvement in the Korean War, ammunition-manufacturing lines at Redstone Arsenal, under the command of the Ordnance Ammunition Center in Joliet, Illinois, were reactivated from standby status in July 1951. Although production orders decreased following the armistice of July 1953, Redstone continued production until the Ammunition Division ceased to exist in June 30, 1956. The Korean War and the threat of worldwide communism encouraged the expansion of the Army's missile program.<sup>34</sup>

Redstone assumed a national procurement mission as part of its industrial mission in early 1951. The industrial mission involved the direction, execution, and control of activities associated with industrial mobilization planning, procurement, and quality control of arsenal mission items. In August 1953 the arsenal was assigned R&D of liquid

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<sup>33</sup> Ordway and Sharpe, p. 356.

<sup>34</sup> Gaither and Peter, p. 15.

propellants, liquid oxygen, and other industrial gases. Redstone was designated mission arsenal for industrial activities involving remotely controlled aerial targets and associated ground guidance and launching systems in November 1953. In July 1955 the national industrial variable time fuze mission was transferred to Redstone. Redstone's industrial mission was assigned to the Army Rocket and Guided Missile Agency (ARGMA) on April 1, 1958.

Field Service became a national mission for Redstone in August 1951. The arsenal operated a National Maintenance Point and Field Service Division in the Ordnance Guided Missile Center. It maintained spare parts and stock lists, prepared technical manuals and parts lists, assigned stock numbers, established maintenance procedures, supervised inspectors and instructors, and provided training. Additional tasks included the maintenance of guided missile material, which was assigned October 1953, and the operation of a guided missile ammunition evaluation and procedures shop for Army guided missile systems. ARGMA assumed the Redstone Arsenal field service function on April 1, 1958.

In addition to operating necessary activities to support the arsenal's mission agencies, Redstone Arsenal also provided administrative and logistical support to other activities located on post. The arsenal operated the U.S. Army Provisional Redstone Ordnance School in 1952 and provided support to the activity when it was officially established as the Ordnance Guided Missile School in February 1953. Military and civilian personnel were trained in the handling and maintenance of rockets and guided missiles. The school taught missile design, development, testing, and prototype manufacture while providing instruction on the development of maintenance programs, training courses, and deployment procedures. The school currently occupies almost 140 buildings on 375 acres in the northeast corner of the arsenal. It uses approximately 3,310 acres for outdoor training. The Transportation Corps Movement Control Office, which was located at Redstone from October 1954 to July 1955, was another tenant supported by the arsenal. Redstone also provided certain services to contractor facilities on post.

During the early 1950s, Redstone was assigned the task of providing R&D for a variety of rockets. Some of the smaller, short-range tactical rockets included the T137 Area Saturation Weapon; the T205E1 and T206E1 High Explosive Anti-tank Rockets (designated M35 and M36, respectively, in August 1955); the T209 white phosphorus rocket; the T210 high explosive rocket; the T229 rocket, which was designed to drop propaganda leaflets; the T212 ground-to-air rocket; the T225 High Explosive Anti-aircraft Rocket; the T237 field artillery rocket; the T238 Area Toxic Rocket Weapon System; the T266 High-velocity Anti-tank Rocket; and the T277, T280, and T282 Boosted Rocket Tank Weapon Systems, which were designed to be mounted on tanks.

Redstone Arsenal also played a major role in the development of the U.S. Army's first major missile systems. In addition to conventional warheads, many of these missiles were capable of launching small, tactical nuclear warheads. The TYPE I CORPORAL was the Army's first successful short-range surface-to-surface missile. Deployed in 1952, CORPORAL ballistic missile battalions were the first missile units activated in the



U.S. The CORPORAL was later replaced by the SERGEANT, which was also designed at Redstone. The HONEST JOHN was a large-caliber field-artillery rocket. In April and May 1954, HONEST JOHN and CORPORAL missile units participate in *Operation Flashburn*. This exercise, which occurred at Fort Bragg, North Carolina, was the first large-scale training exercise for the atomic battlefield. The LACROSSE was a surface-to-surface missile designed for close tactical support of ground troops, while the LITTLEJOHN was a highly mobile free-flight field-artillery rocket. The DART was a ground-launched missile guided by a wire control line.

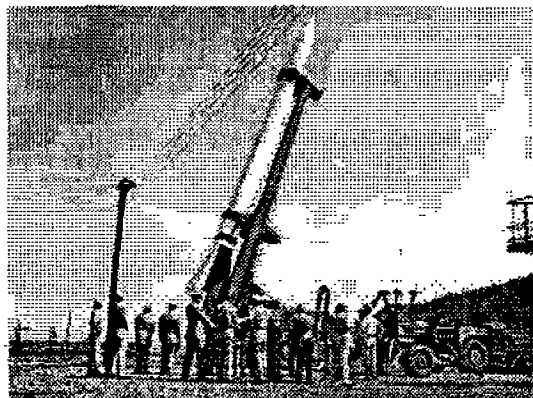


Figure 11. The CORPORAL missile mounted on a portable launcher.

Surface-to-air missiles designed at Redstone Arsenal included LOKI, America's first free-flight anti-aircraft rocket. This missile had its origins in the designs of the *Operation Paperclip* scientists. The NIKE AJAX, NIKE HERCULES, and NIKE ZEUS were surface-to-air continental defense missiles. The NIKE AJAX was a conventional weapon that was first fielded in 1954. Development began on the nuclear-capable NIKE HERCULES in 1956. PLATO was an anti-missile missile designed to destroy incoming ballistic missiles. The HAWK was designed as a surface-to-air medium-range guided missile for defense against aircraft at low to medium altitude. Variants of some of these more successful designs continued to be used by the U.S. and its allies into the 1980s and 1990s.



Figure 12. The SERGEANT.

Out of all the Cold War missions of Redstone Arsenal, however, the guided missile programs developed by von Braun and fellow *Operation Paperclip* team members gained the most attention and proved to be most significant. From the national and strategic Cold War perspective of the 1950s, exceptionally important R&D was conducted at Redstone Arsenal. With the arrival of the Fort Bliss group and the subsequent creation of the Guided Missile Center, the arsenal became responsible for the R&D of large, liquid-fueled, guided missiles. Whereas a rocket is, historically, a weapon that is pointed and fired, a guided missile is directed by signals outside or sensors within that adjust the course of the

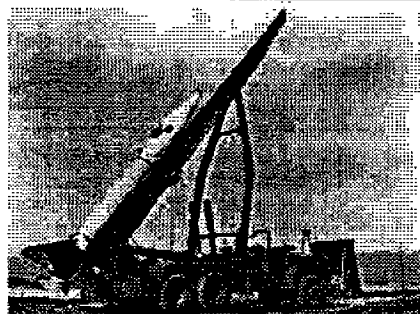


Figure 13. The HONEST JOHN.

vehicle during flight. Free flight rockets have been used as weapons for centuries. Allied and Axis forces used rockets against tanks and infantry throughout most of World War II. Other than the operational V-2, used by Nazi Germany during World War II, the development of the guided missile was still only in an experimental phase by 1950. The guided missile was, essentially, born and bred during the Cold War.



Figure 14. The NIKE family of missiles.

At Redstone Arsenal the staff of the Guided Missile Center, and its successor organizations, developed the guided missile as a launch vehicle for nuclear weapons. Their work included component and system development in the fields of aerodynamics, guidance and control, propulsion, assembly techniques, transportation, testing, and launching. The missiles designed by these men would become important weapons in America's nuclear arsenal and serve as vehicles for boosting America's first satellites into space. In Huntsville, von Braun's team "closed the 20-year-gap in space technology" and developed the series of intermediate range ballistic missiles (IRBMs) that "formed the backbone of the NATO armory and deterred the Soviets in Europe until the Soviet Union collapsed in economic chaos."<sup>35</sup>

Toftoy, who was by 1950 a major general, was responsible for gaining approval for the transfer of Hamill, the *Operation Paperclip* group, and 400 American scientists to Redstone Arsenal. Hamill's scientists "became the nucleus of the new arsenal staff."<sup>36</sup> Von Braun's group conducted guided missile R&D in the old Huntsville Arsenal area. Laboratories were initially located in the old administration area, which was on Ward Mountain, and Plants Area No. 1, located to the south. The Guided Missile Test Area was built to the south of Plants Area No. 1. In 1952 a static-fire test stand, test laboratory, and blockhouse, designed by Parsons-Aerojet Company, was constructed in the test area.<sup>37</sup>

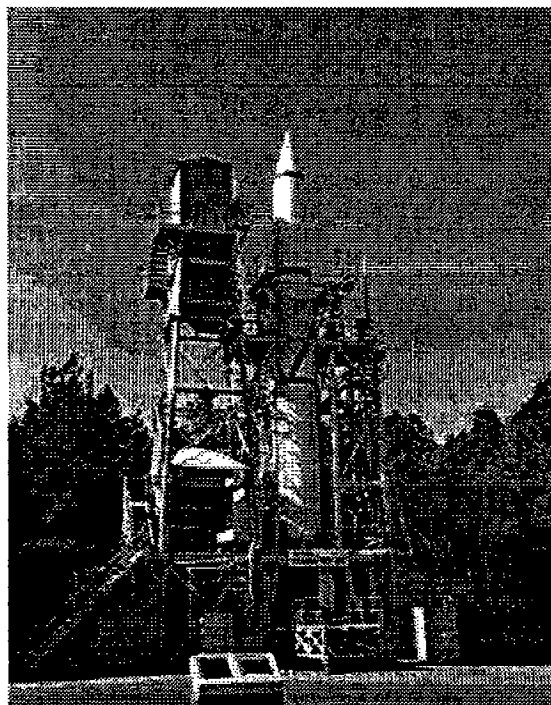


Figure 15. A 1993 photograph of the REDSTONE rocket and test stand at Redstone Arsenal.

The Ordnance Guided Missile Center and the Ordnance Rocket Center were

<sup>35</sup> Breuer, p. 197.

<sup>36</sup> Ordway and von Braun, p. 164.

<sup>37</sup> Gaither and Peter, p. 15.

renamed Guided Missile Development Division and Rocket Development Division, respectively, and combined in September 1952 to form the Ordnance Missile Laboratories (OML). OML served as the main source of technical information on rockets and guided missiles in the Ordnance Department.

***R&D of "Old Reliable," the REDSTONE Rocket***

Von Braun and his group received their first official assignment as part of the newly formed Ordnance Guided Missile Center in July 1950. They were tasked to design a 500-mile-range surface-to-surface missile. The final product would be the REDSTONE: a ballistic missile capable of accurately placing a heavy thermonuclear warhead on a target 200-miles away. Originally part of *Project Hermes*, the missile that would be REDSTONE was first known as HERMES C1. It was also known as MAJOR, URSA, XSSM-A-14, and XSSM-G-14. It was officially renamed REDSTONE in April 1952. Although the missile was originally intended to have a range of 500 miles, requirements of the U.S. Army in the Korean War dictated an increase in payload and a decrease in range. It was therefore developed as a tactical battlefield weapon or a mobile nuclear threat. The REDSTONE was essentially a second-generation V-2 that incorporated an inertial guidance system. Propellant tanks formed the outer structure of the lower stage, which was constructed of aluminum. A short-range ballistic missile, the REDSTONE would serve an important role in the long-range plans of von Braun and his men

Redstone Arsenal fabricated and produced the first twelve prototype REDSTONE missiles with components provided by contractors. The first successful test firing of a REDSTONE occurred August 20, 1953. Chrysler Corporation received a contract to produce REDSTONE missiles in June 1955. The first REDSTONE missile to be fabricated and assembled by Chrysler was test flown on July 19, 1956. The REDSTONE proved to be a highly accurate and dependable weapon. The 40th Field Artillery Missile Group (Heavy) joined the NATO Shield Force in June 1958. Armed with REDSTONES, it was the first large U.S. ballistic missile unit to be deployed overseas. On July 31, 1958, a REDSTONE missile carrying a nuclear device was fired to a height of over 200,000 feet and detonated. This was the first such test successfully completed by the U.S.<sup>38</sup> The REDSTONE was eventually phased out as a tactical Army missile system in the early 1960s. The ceremonial retirement of "Old Reliable" occurred at Redstone Arsenal on October 30, 1964.

During the development of the REDSTONE rocket, many of the German-born scientists of the *Operation Paperclip* group in Huntsville were naturalized. On November 11, 1954, 39 of the men and two of their wives were sworn in as American citizens. At a large ceremony at Huntsville High School on April 14, 1955, 103 of the group and members of their families became American citizens. According to Baker et al, these events "had a favorable impact on the arsenal's overall public relations image because it

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<sup>38</sup> Michael E. Baker, Dr. Kaylene Hughes, and Claus R. Martel, "Redstone," *Redstone Arsenal Historical Information*, Internet Homepage, U.S. Army Aviation and Missile Command, Redstone Arsenal, Ala.

eliminated the stigma of 'aliens' working on highly classified missions for U.S. defense."<sup>39</sup>

### *Project Orbiter*

Although he was successfully developing missiles for the delivery of nuclear weapons, von Braun was also dreaming of space. Von Braun was a great visionary who had the ability to inspire and lead. He became a spokesman for space exploration and frequently published articles about space travel with spaceship designs. In November 1955 von Braun received the second annual

Astronautics Award from the American Rocket Association. The award was given to individuals who made significant contributions to the science of astronautics. Walt Disney was so impressed with von Braun that he used von Braun's models in designing the *Tomorrowland* section of Disneyland. Von Braun also participated in several Disney productions for children about space travel and exploration.

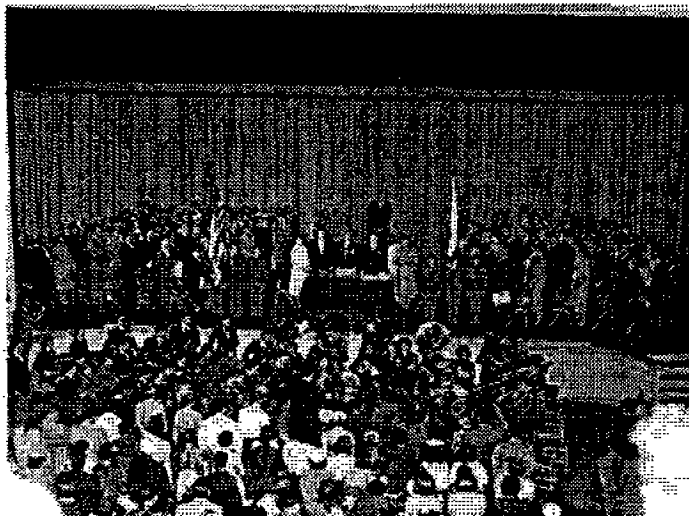


Figure 16. Naturalization ceremony at Huntsville High School, April 14, 1955.

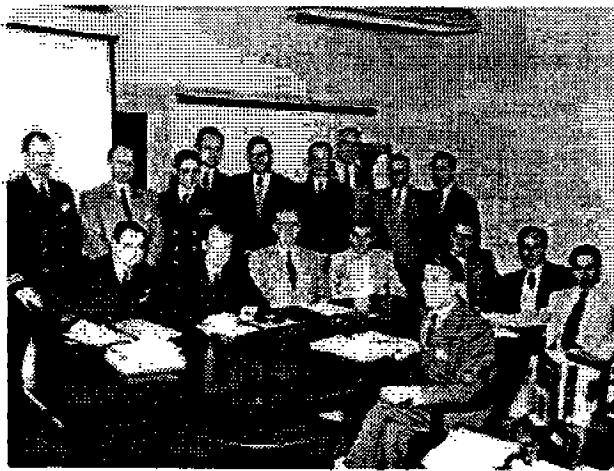


Figure 17. The *Project Orbiter* group, Washington, D.C., June 1954.

rocket. Commander George W. Hoover liked the proposal. *Project Orbiter* was approved as a result of the meeting.

Von Braun began to press for the launch of a man-made earth satellite shortly after his arrival in Huntsville. He first suggested a coordinated space program to develop a satellite vehicle in February 1952. Following the success of the REDSTONE, von Braun proposed a joint Army-Navy effort to launch a satellite. He outlined his idea during a meeting at the Office of Naval Research in Washington, D.C., on June 25, 1954. Von Braun's plan called for the launch of a five-pound satellite into orbit on a modified REDSTONE

<sup>39</sup> Baker et al, "Redstone Arsenal Complex Chronology: The Redstone Arsenal Era, 1950-1955, Part II."

Von Braun continued to develop his idea. On September 15, 1954, he produced a top-secret report entitled *A Minimum Satellite Vehicle Based on Components Available from Developments of the Army Ordnance Corps*. This report, which served as a foundation for *Project Orbiter*, proposed using the REDSTONE missile as the main booster of a four-stage rocket for launching artificial satellites. The launch date for the satellite was set for September 1956.

Von Braun knew that America was in a Cold War Space Race with the Soviet Union. He recognized the importance of America beating Russia into space. According to von Braun

The establishment of a man-made satellite, no matter how humble, e.g., five pounds, would be a scientific achievement of tremendous impact. Since it is a project that could be realized within a few years with rocket and guided missile experience available *now*, it is only logical to assume that other countries could do the same. *It would be a blow to U.S. prestige if we did not do it first.*<sup>40</sup>

Unfortunately, President Dwight D. Eisenhower did not share von Braun's concern. A political decision based on U.S. involvement in the International Geophysical Year (IGY) derailed *Project Orbiter*.

#### ***Project Vanguard and the International Geophysical Year***

IGY was scheduled to start July 1, 1957. It was an 18-month program designed to increase mankind's knowledge of the earth by pooling research from 40 nations in the fields of meteorology, longitude and latitude determinations, geo-magnetism, gravity measurements, solar activity, cosmic rays, and oceanography. Both the U.S. and Soviet Union decided to contribute to IGY by launching a satellite into space.

In March 1955 a committee met to determine what rocket would be used to launch the American IGY satellite. The three options were the ATLAS, an Air Force intercontinental ballistic missile (ICBM) which was not yet operational; JUNO I, a modified REDSTONE design that was the result of *Project Orbiter*; and the new Navy VANGUARD, a highly-advanced three-stage rocket whose second and third stages were yet to be designed. Many IGY committee members thought it would be inappropriate to use a military launch vehicle, such as ATLAS or REDSTONE, on a peaceful international space project. Some IGY committee members found the *Project Orbiter* design inelegant, while others believed the first American satellite should be launched by a rocket designed by Americans – not by one designed by Germans. The committee consequently recommended VANGUARD.

As a result of this recommendation, Eisenhower announced at a press conference on July 29, 1955, that the U.S. would contribute to IGY by launching a satellite with a new, nonmilitary rocket. Known as *Project Vanguard*, the effort would be directed by the

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<sup>40</sup> Ordway and Sharpe, p. 376.

National Academy of Sciences and the National Science Foundation. The Naval Research Laboratory would build the new rocket, whose first stage would be based on the Navy's VIKING, a highly successful research rocket.

Because of Eisenhower's decision, the U.S. Army's official role in America's space satellite program came to an abrupt halt. Instead of using available technology, such as the tested and proven REDSTONE rocket, *Project Vanguard* went back to the drawing board. Von Braun considered this a fateful, wrong decision that would give the Soviets the lead in the space race. When White House spokesmen referred to *Project Vanguard* as a "dignified" program because it would not use an existing weapon to launch the satellite, von Braun responded

I'm all for dignity, but this is a Cold War tool. How dignified will the United States be if a man-made moon of Soviet origin suddenly appears in the sky?<sup>41</sup>

Although they lost *Project Orbiter*, von Braun and his staff never gave up hope of launching a satellite. About the same time the IGY committee was in the process of selecting a launch vehicle for America's first satellite, the Technological Capabilities Panel of the Department of Defense recommended concurrent development of IRBMs by the Army and Air Force. This decision was made in response to a perceived "missile gap" between the U.S. and U.S.S.R. In order to remedy shortcomings in its nuclear missile program, the U.S. decided to focus on developing an effective IRBM, which could serve as a viable nuclear deterrent, until the ICBM became operational. The proposed IRBM, with a 2,500-pound payload capacity, would be capable of launching a lightweight thermonuclear device. It would have a 150,000-pound thrust motor and a 1,500-mile range. In July 1955 the Army proposed a missile design that was essentially a modified REDSTONE.

Concern over the Soviet Union's efforts to develop an ICBM prompted the Pentagon to initiate crash programs for the development of the two American IRBMs. The Air Force had so far been unsuccessful in developing the ATLAS and TITAN ICBMs into operational status. "Public opinion demanded the perfection of similar weapons in short order" to overcome this "missile gap."<sup>42</sup> The Air Force's IRBM #1 and the Army's IRBM #2, which were later named THOR and JUPITER, respectively, were to be developed concurrently. In November 1955, Secretary of Defense Charles E. Wilson assigned the Army and Navy the task of producing IRBM #2 with sea- and land-based capabilities. Secretary of the Army Wilbur M. Brucker gave IRBM #2 the highest priority of any Army R&D project. Eisenhower approved the ICBM and IRBM programs with the highest national priorities in December 1955. Von Braun and his team began work on their new project with one eye toward space.

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<sup>41</sup> Breuer, p. 139.

<sup>42</sup> Baker et al, "The Army Ballistic Missile Agency and its Special Delegations of Authority."

### 3.3.2 Leaders in the Space Race and Nuclear Arms Race: 1956-1960

#### *The Creation of ABMA and the Development of JUPITER*

In order to expedite the deployment of REDSTONE and facilitate R&D of JUPITER, the Army formally activated the Army Ballistic Missile Agency (ABMA) at Redstone Arsenal on February 1, 1956. Von Braun became director of Development Operations Division, which formed the core of ABMA, and assumed a vital leadership role in the new agency. ABMA was the first agency in the U.S. created exclusively for the development of ballistic missiles. The new organization inherited 1,600 personnel, \$21 million in equipment, and \$2.5 million in support facilities from Guided Missile Development Division.

The decision to create ABMA at Redstone Arsenal was based upon the availability of facilities and expertise at the site. Redstone Arsenal had a complete static test building with two vertical test stands capable of containing 500,000 pounds of thrust, a horizontal test stand, a cold calibration stand, a blockhouse, and support buildings. These assets were due to be completed and in operation by early 1956. The arsenal had well-equipped laboratories, a large computation laboratory, facilities for mechanical component development, and structural testing facilities. The arsenal had the highest-trained and most technologically up-to-date staff of scientists and engineers in the Free World. ABMA staff had 19 employees with doctorates, 78 with master's degrees, and 424 with bachelors degrees in various scientific areas. Redstone Arsenal had development shops and assembly buildings capable of fabricating complete missiles the size of the REDSTONE at a rate of two per month. Staff had experience developing and fielding missile systems and had recently turned over production of the REDSTONE to contractors. This meant that the full industrial capacity of the arsenal would be available for fabricating the JUPITER.

Because of JUPITER's high national priority, the Secretary of the Army, through the Chief of Ordnance, delegated special authorities to the new commanding officer of ABMA, Major General John B. Medaris. Medaris was the former chief of the Industrial Division

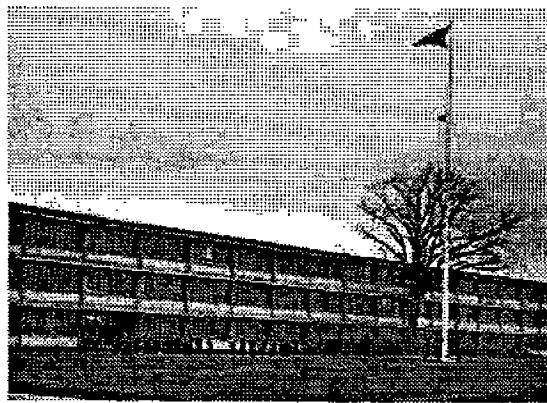


Figure 18. The activation of ABMA at Building 4488, February 1, 1956.



Figure 19. Major General John B. Medaris.

of the Ordnance Department. As ABMA commanding officer, he was featured in publications and appeared as a frequent guest on national television news programs. According to Baker, Medaris, because of his power and influence, "was *hardly* just a CO [commanding officer]."<sup>43</sup> His powers pertaining to R&D and procurement were the most that could legally be delegated. Medaris, as commanding officer of ABMA, could deviate from standard Army procurement procedures and regulations, use other Army Ordnance facilities on a priority basis, and issue instructions directly to other Army agencies. He could also bypass the chain of command and directly contact the Secretary of the Army and the Chief of Staff.

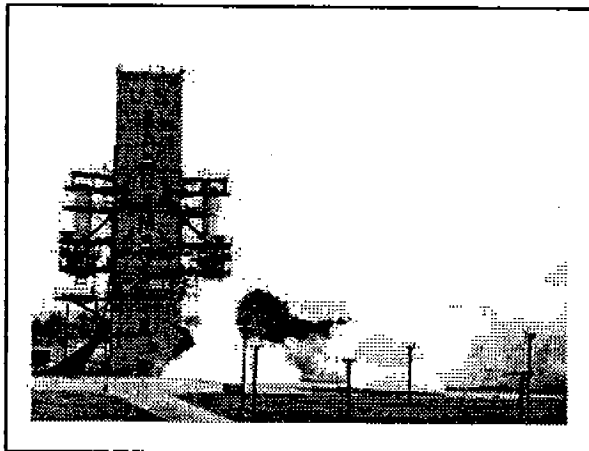


Figure 20. Static test at the Propulsion and Structural Test Facility (Building 4572), Guided Missile Test Area, Redstone Arsenal.

Medaris became an exceptionally important figure in the Cold War, comparable to Air Force General Curtis LeMay. LeMay, commanding officer of Strategic Air Command, is considered exceptionally important in Cold War history due to the authority and funds at his disposal. Medaris, for example, had almost \$2 billion under his control in 1959 and 1960 for missile R&D. This amount comprised almost 25 percent of the U.S. Army's entire budget.<sup>44</sup>

Unencumbered by the usual bureaucracy, ABMA was able to make great strides in developing the JUPITER program throughout 1956. Construction began on the Propulsion and Structural Test Facility in the Guided Missile Test Area. The largest static test stand in the U.S. for testing rocket motors, this facility was slated for use in developing JUPITER. During this time one of the Army's first computers was installed in what is now Building 4619 to serve the blockhouse in the Guided Missile Test Area, which was the control center for the Propulsion and Structural Test Facility.

The technical core of ABMA consisted of Development Operations Division, the former Guided Missile Development Division of OML, which was under the directorship of von Braun. According to Toftoy, the "key technical personnel and laboratory chiefs of ABMA were members of the original *Paperclip* group."<sup>45</sup> These scientific leaders were authorities in their fields and belonged to committees and organizations such as the National Academy of Sciences.

<sup>43</sup> Michael E. Baker, e-mail communication, September 16, 1999.

<sup>44</sup> Joiner and Jolliff, p. 80.

<sup>45</sup> Toftoy and Hamill, p. 14.



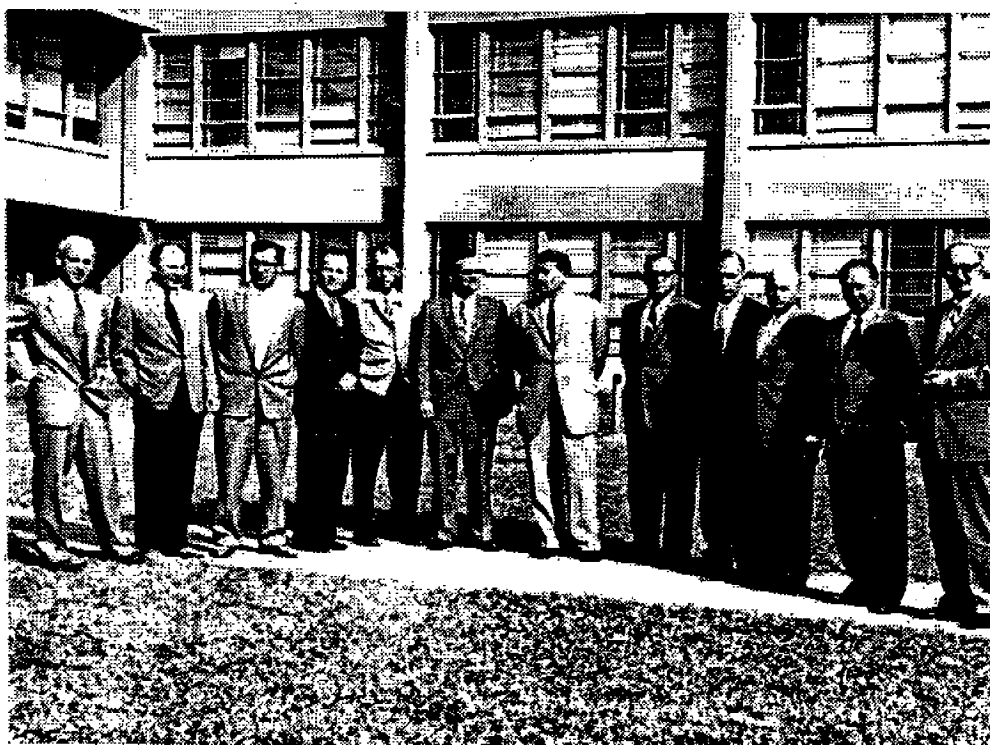


Figure 21. Development Operations Division Chiefs, June 1959, left to right: Dr. Ernst Stuhlinger, Research Projects Office; Dr. H. Hoelzer, Computation Laboratory; K.L. Heimburg, Test Laboratory; Dr. E.D. Geissler, Systems Analysis & Reliability Laboratory; Dr. W. Haeussermann, Guidance and Control Laboratory; Dr. Werner von Braun, Development Operations Division; W.A. Mrazek, Structures and Mechanics Laboratory; Hans Hueter, System Support Equipment Laboratory; Eberhard Rees, Deputy Director, Development Operations Division; Dr. Kurt Debus, Missile Firing Laboratory; H.H. Maus, Fabrication and Assembly Engineering Laboratory.

The ABMA staff was so confident of JUPITER's potential for success that the Department of the Army advised the Department of Defense in April 1956 that the JUPITER C missile could launch a satellite into orbit by January 1957. In May 1956, however, the Department of Defense denied the Army's request that JUPITER be used as an alternate to VANGUARD. Furthermore, the Army was instructed to initiate no plans for using the JUPITER or REDSTONE as satellite launch vehicles.

Evolving directly from the REDSTONE, the JUPITER C was a highly successful missile. It consisted of an elongated REDSTONE booster as the first stage, clusters of scaled-down SERGEANT rockets as the second and third stages, and a scaled-down JUPITER nose cone. Three of these rockets were launched as JUPITER reentry test vehicles between September 20, 1956, and August 8, 1957.

The JUPITER C RS-27, which was launched on September 20, could have easily placed an American satellite into orbit. According to Hughes, the missile "flew 3,355 miles; attained an altitude of 682 miles; and achieved a velocity of Mach 18, enough to have put its fourth stage into orbit if permission had been granted to do so."<sup>46</sup> Quite to the contrary, there were no "live" fourth stages allowed in storage at Cape Canaveral. Department of the Army inspectors checked to make sure all fourth stages were loaded with sand – they did not want von Braun and his staff to "accidentally" launch a satellite into orbit and "upstage" *Project Vanguard*.<sup>47</sup> RS-27, traveling at a rate of 16,000 miles per hour, flew faster and farther than any American missile had ever flown. This record stood until the advent of ICBMs.

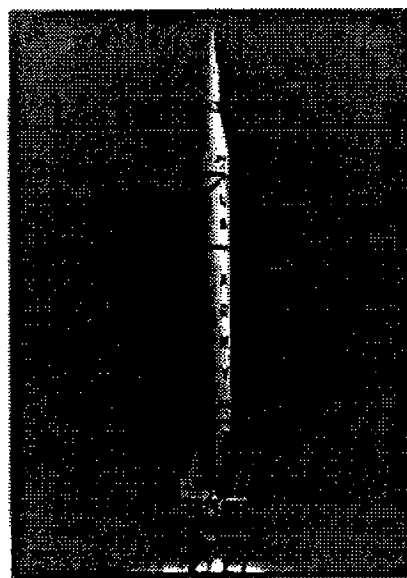


Figure 22. JUPITER C RS-27, before its record-breaking flight on September 20, 1956.

In direct contrast, however, VANGUARD development was progressing at a much slower rate. ABMA, with its special acquisition powers and adequate funding from the Pentagon, had distinct advantages over director John P. Hagen and his *Project Vanguard* staff. Hagen was under tremendous pressure. His timetable was too tight, initial funding was too small, and the government directive that required "full participation of industry" served to hamstring his efforts to expeditiously complete the project. Competitive bids had to be taken before the most basic experimentation could occur.

Following the successful flight of JUPITER C RS-27, the Army again offered the JUPITER C missile, now a tried and proven product, as an alternative to the VANGUARD. With seven more JUPITER Cs in Huntsville, the Army was sure that it would receive approval to launch a satellite. The only news coming from Washington, however, was bad news: Secretary of Defense Charles E. Wilson issued the "Roles and Missions Directive" on November 28, 1956. This new official policy, which fixed the missile development roles of the military branches, dictated that the Air Force would be responsible for developing rockets with ranges greater than 200 miles, and the Navy would develop ship-launched missiles. Future Army R&D efforts would be confined to missiles with ranges up to 200 miles. It appeared that the Army and von Braun would forever be earth bound.

### ***The Billy Mitchell of the Cold War***

Wilson's directive caused a furor in Huntsville. Many citizens thought this would be the end of Redstone Arsenal's highly successful guided missile program. Medaris was also

<sup>46</sup> Baker et al, "Pioneering Efforts in Space."

<sup>47</sup> Ordway and Sharpe, p. 377.

concerned. He called together his ABMA staff and instructed his officers not to speak publicly against the directive. Wilson's decision had come about as a result of competition between the Air Force and Army over the TALON and NIKE air defense systems and the THOR and JUPITER IRBM programs. Medaris was sure that the Army's relegation to short-range missile development would not last long. In any event, Medaris intended to continue work on JUPITER with the appropriated funds that remained available. Colonel John C. Nickerson, Jr., Chief of the Field Coordinating Office at ABMA, however, was not so confident of the Army's future in missile development. He decided to disobey a direct order and speak out against Wilson's directive – in doing so, Nickerson would earn the sobriquet “Billy Mitchell of the Cold War.”



Figure 23. Colonel John C. Nickerson, Jr.

Brigadier General William Mitchell (1879-1936), known as the “Father of the Air Force,” was an Army pilot who was court-martialed in 1925 for disobeying a direct order. Mitchell, an air power advocate, was told to stop making speeches and writing articles on the military importance of the airplane. When he refused, the Army court-martialed him and found him guilty of insubordination. Instead of accepting a five-year suspension, Mitchell resigned from the Army. The lessons learned from World War II proved that he was right. Americans always knew Billy Mitchell was a principled man with the nation's best interests in mind. The war vindicated him as a soldier who ran afoul of politics.

Nickerson also had the nation's best interests in mind when he rebutted Wilson in his report “Considerations on the Wilson Memorandum.” He sent copies of his 12-page memorandum, with 11 pages of supporting documentation, to John A. Baumann, Chief Executive Officer of RCA; syndicated columnist Drew Pearson; William F. Hunt, chairman of Reynolds Metal Company; Erik Bergaust, managing editor of *Missiles and Rockets* magazine; and Alabama congressmen. He circulated his report to individuals he hoped could influence Wilson to change his decision. In his report Nickerson asserted the superiority of the JUPITER C missile over THOR, and insisted on the need for the Army to operate its own IRBM.

News of the memorandum broke on January 7, 1957. On February 5 the Army announced that Nickerson was relieved of his duties. He was charged with violating two articles of the Uniform Code of Military Justice on 18 specifications, including espionage, perjury, moral turpitude, and failure to safeguard secret information. A court-martial date was set for June.

In the meantime, ABMA continued working on the JUPITER missile. Due to the Wilson Directive, however, the Army was developing a weapon that it would not be allowed to use – once assembled, the JUPITERs would be deployed and controlled by the U.S. Air

Force. On April 19, 1957, Wilson presented von Braun with the Department of Defense's Civilian Service Award for his work in the Army missile program.

JUPITER AM-1, launched on May, 31, 1957, was the first successful American IRBM.<sup>48</sup> In the wake of the event, the *Huntsville Times* reported that "one high ranking scientist contended the Army has been forced for two months to sit on a completed missile capable of launching the 20½-pound baby moon which the United States wants to send hurtling around the globe." Von Braun, happy with the success of JUPITER AM-1, was frustrated because he and the Army were not allowed to launch a satellite. He was quoted in the article as saying, "it is a difficult thing for a team which has the lead in eggs not to get the opportunity to hatch at least one of them."<sup>49</sup>

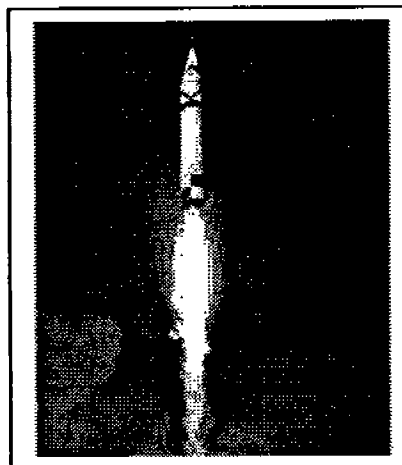


Figure 24. America's first IRBM, JUPITER AM-1, May 31, 1957.

With the summer of 1957 came the court-martial of Nickerson. His trial was held in Building A-132 (now Building 7132), which is located in the old Redstone Ordnance Plant area. It was an event that attracted nationwide attention. Nickerson and his attorneys held a press conference at the Russel Erskine Hotel in downtown Huntsville on the Sunday before the trial. More than a dozen newsmen attended. They represented the *New York Times*, Associated Press, International News Service, Telenews, Movietone News, *Birmingham Post-Herald*, Scripps-Howard Newspapers, CBS, *New York Daily News*, *Huntsville Times*, and others. Trial credentials were issued to 71 members of the press, including United Press, *Baltimore Sun*, *Toledo Blade*, *Chattanooga Times*, *Newsweek*, *Time*, *Life*, and *Missiles and Rockets Magazine*.<sup>50</sup>

The trial began on Tuesday, June 25.<sup>51</sup> The general court-martial board consisted of five generals and five colonels with Major General Crump Garvin serving as president of the court. Lieutenant Colonel William G. Barry served as chief prosecutor. On the morning of the first day the Army withdrew all of the charges against Nickerson except failure to safeguard secret information, to which Nickerson promptly pleaded guilty. The trial then entered another phase. With guilt determined, testimony would be introduced in an effort by the defense to show mitigating or extenuating circumstances for Nickerson's actions.

Nickerson's defense team was Ray H. Jenkins, who played a major role as Senate counsel in the McCarthy hearings, local attorney Robert K. Bell, Lieutenant Colonel Charles

<sup>48</sup> Baker et al, "Redstone Arsenal Complex Chronology, Part II: Nerve Center of Army Missilery, 1950-1962, Section B: The ABMA/AOMC ERA (1956-62)."

<sup>49</sup> "ABMA Earth Satellite Missile Reported Ready: 'Army Eager' After Success With Jupiter," "Rocket to Lift 'Moon' Has Been Ready Two Months, Scientist Says," *Huntsville Times*, 6 June 1957, p. 1.

<sup>50</sup> "71 Newsmen Sign to Report Trial," *Huntsville Times*, 26 June 1957, p. 3.

<sup>51</sup> "Guilt Plea Entered on Charge 1: U.S. Drops Espionage Case on Nickerson," *Huntsville Times*, 25 June 1957, p. 1.

Zimmer, and Lieutenant Lewis Cole. Their goal was to show that Nickerson had acted with the nation's best interests in mind and that the information he released should not have been classified "secret."

Key witnesses included Dr. Ernst Stuhlinger, director of the Research Projects Office of the Development Operations Division at ABMA. Stuhlinger, an *Operation Paperclip* scientist, testified that the Wilson directive had severely lowered the morale of ABMA staff. In the wake of the announcement, many of the most talented Army scientists had received lucrative offers from private industry. He noted that the break-up of von Braun's research team, many of whom had worked together for over 20 years, would not be in the best interests of the United States, especially in light of Soviet advances in missile development. Stuhlinger asserted that the *Paperclip* group and the rest of the Army team had been kept together only because of the efforts of von Braun, Medaris, and Nickerson.

Von Braun testified that the Army's highly rigid security measures were at times a handicap to missile development. He said that such security had oftentimes prevented the taxpayers and Congress from being informed about Army achievements and that, consequently, the Air Force, with its effective use of publicity, was getting much higher levels of funding. According to von Braun, "when the Army gets a dollar it uses 90 cents for research and development, and the remaining 10 cents for publicity . . . when the Air Force gets a dollar, it uses 50 cents on publicity to get another dollar to be used on development."<sup>52</sup> The defense attempted to show that although the documents in Nickerson's possession were stamped "secret," there were actually no real defense secrets in them — they might not have even been classified by Air Force standards.

The trial turned into more of a showcase of interservice rivalry when Nickerson took the stand. In his testimony he accused the aircraft industries, which received "bloated" missile contracts from the Air Force, of using lobbyists to "pull the plug" on the Army IRBM program. He said that although his methods were wrong, the ultimate motive behind his memorandum was to get permission for the Army to maintain operational control of JUPITER. He also pointed out that THOR was not top priority for the Air Force.<sup>53</sup>

Medaris' testimony against Nickerson was severe. He said he would not want Nickerson to serve in his organization again, and that the colonel had no future military service value. Under cross-examination by Jenkins, however, Medaris admitted that Nickerson had a "good end in mind," and agreed that the JUPITER C was superior to THOR.<sup>54</sup>

On June 29 the court-martial board spent 26 minutes behind closed doors deciding Nickerson's fate. Facing up to 10 years in prison and a \$10,000 fine, his penalty

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<sup>52</sup> "Dr. Von Braun Hits Security Measures in Use by Army," *Huntsville Times*, 27 June 1957, p. 1.

<sup>53</sup> "Nickerson Stands by Aims, But Admits Methods Wrong," *Huntsville Times*, 28 June 1957, p. 2.

<sup>54</sup> Breur, p. 146; "Medaris Sinks Nickerson's Hope for Career in Rockets: Says Convicted Officer Has No Future Potential Military Service Value," *Huntsville Times*, 30 June 1957, p. 1.

amounted to a slap on the wrist: he received an official reprimand, was suspended from rank for one year, and fined \$100 per month (out of a monthly paycheck of \$900) for 15 months.<sup>55</sup> Four weeks later he was assigned to the Panama Canal Zone as head engineer at Fort Clayton.

Work on JUPITER at Redstone Arsenal continued for the rest of 1957, but without Nickerson. One of the design problems solved by the ABMA team that year concerned the nose cone of the missile. A significant difference between a 200-mile short-range missile and a 1,500-mile IRBM is that the IRBM is launched high into the earth's atmosphere. As it descends, the nose cone is subjected to extremely high levels of heat that could damage or destroy the payload. ABMA scientists hoped to solve this problem by using a fiberglass ablation nose cone.

The third launch of a reentry vehicle, JUPITER C RS-40, on August 8, 1957, proved the soundness of ABMA's design. This missile was tipped with a one-third-scale model of the nose cone. As it descended back into the earth's atmosphere the nose cone melted slowly, thereby protecting the area where the warhead would be located. The nose cone was the first man-made object retrieved from outer space. It also carried the first missile mail delivered to the range of an IRBM. Although the Army missile team had proved their mettle through repeated trials, on the test range and in the court room, America would have to face a national emergency before von Braun and his team of rocket scientists would be allowed to reach for the stars. That national emergency was not far away.

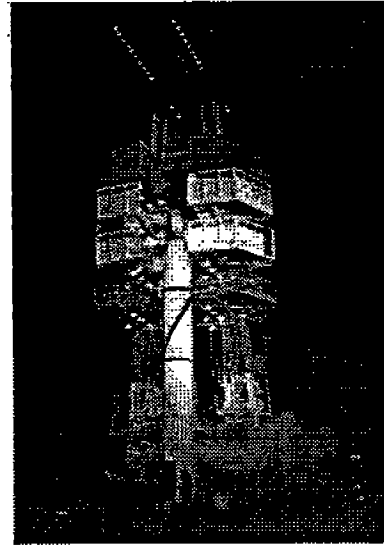


Figure 25. The launch of JUPITER C RS-40, August 8, 1957, with fiberglass ablation nose cone.

### ***The Soviet SPUTNIK and the American EXPLORER***

The launch of the Soviet satellite SPUTNIK on October 4, 1957, was, in essence, a Cold War "Pearl Harbor." SPUTNIK was a serious Cold War defeat for America. According to Mary Stone Ambrose,

For the first time since Pearl Harbor, the United States was seriously challenged and surpassed in the field where it was thought to be supreme, the field of technology and industrial know-how. While the West had disregarded previous reports of Soviet scientific accomplishments and had underestimated the ability of this regimented society to develop complex hardware such as the Intercontinental Ballistic Missile or an earth satellite, the advent of the Sputnik served notice to the world of the Russian

<sup>55</sup> "Colonel Gets 'Slap on Wrist,'" *Huntsville Times*, 30 June 1957, p. 1.

achievement in science and technology. The spectacular demonstrations of the Sputniks must have shattered any myths regarding the state-of-the-rocket-art behind the Iron Curtain.<sup>56</sup>

Referring to SPUTNIK, Stuhlinger writes, "then came the fateful 4th of October 1957 with the first launching of an artificial earth satellite . . . almost within hours, it became strikingly evident that the step into space means far more than a scientific dream; it is a national challenge, and it affects the prestige, and even the security, of any great nation that desires to retain its place among other nations."<sup>57</sup> In *The Challenge of the Sputniks* (1958) editor Richard Witkins notes that the American public was shocked by SPUTNIK because they were not prepared for the Soviet feat.

The Eisenhower Administration, however, was shocked by public reaction. Intelligence reports had made them aware that the launch was imminent, but they "underestimated the extent of the psychological reaction both in this country and abroad."<sup>58</sup> In *Second-Rate Brains*, Lloyd Berkner notes that "the truth is that the Soviet satellites have shocked Americans into an awareness of the phenomenal rise of Soviet science during the last 30 years. We are chagrined to have lost the lead that American science, we believe, should have maintained."<sup>59</sup>

It is important to note that SPUTNIK was entirely a psychological defeat. Von Braun and his missile team had the ability to launch a satellite in September 1956 with JUPITER C RS-27. If *Project Orbiter* had not been terminated in 1955, the U.S. might have been able to launch a satellite even earlier. It is also important to note that although the Eisenhower Administration had had qualms about using a weapons system, such as ATLAS or REDSTONE, for *Project Vanguard*, the Soviets did not hesitate in launching SPUTNIK into orbit on the tip of an ICBM. According to Rosholt, "as it turned out, the orbiting of the first manmade satellite became a very potent 'weapon' in the cold war . . . this was not fully understood until after the great propaganda success of SPUTNIK I."<sup>60</sup>

Vice-President Richard M. Nixon had previously advised Eisenhower to make the public aware of the impending launch of SPUTNIK so as to buffer the impact. Eisenhower declined. The president did not view the Space Race as a significant part of the Cold War, and he did not believe there would be an adverse public reaction. He regarded the militarization of space as very important, and therefore energetically pursued the development of ballistic missiles. But he considered it a "stunt" to launch a satellite merely because the U.S. had such a capability. Following SPUTNIK, however, Nixon said, "we could make no greater mistake than to brush off this event as a scientific stunt.

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<sup>56</sup> Mary Stone Ambrose, "The National Space Program - Phase I: Passage of the National Aeronautics and Space Act of 1958" (Master of Arts thesis, American University, 1960), p. 21.

<sup>57</sup> Ernst Stuhlinger, "Army Participation in the National Satellite and Space Program," address made to the American Rocket Society Semi-Annual Meeting, 9 June 1959, p. 2.

<sup>58</sup> Ambrose, p. 20.

<sup>59</sup> Kermit Lasner, ed., *Second-Rate Brains* (Garden City, N.Y.: Doubleday and Company, Inc.), 1958.

<sup>60</sup> Robert L. Rosholt, *An Administrative History of NASA, 1958-1963*, Washington, D.C.: Scientific and Technical Information Division, National Aeronautics and Space Administration, 1966, p. 5.

We have had a grave and timely reminder . . . that the Soviet Union has developed a scientific and industrial capacity of great magnitude." Witkin notes that this "constituted the first real public admission by the Administration that the nation was in trouble."<sup>61</sup>

SPUTNIK was a big blow to national pride for America. According to Breuer, "Sputnik scored an enormous propaganda coup in the Cold War struggle."<sup>62</sup> The Soviet Union could claim that such a feat demonstrated the superiority of communism. The technological and military implications of SPUTNIK caused a public outcry in America. Demands were made to overhaul the educational system (which resulted in the National Defense Education Act of 1959), to appoint a missile czar, to create a Department of Space, and to institute a crash missile program to catch the Russians.

It was coincidental that Neil McElroy, recently selected to become new Secretary of Defense, was visiting Redstone Arsenal on October 4, 1957. Former CEO of the Proctor and Gamble Company, he was at the arsenal for an orientation tour. In his group were Secretary of the Army Wilbur M. Brucker, Army Chief of Staff Lyman Lemnitzer, and the Army Chief of Research and Development, Lieutenant General James M. Gaven. A dinner was held that evening at the post for the secretary-select and his entourage. The festivities were attended by key ABMA officials and Huntsville city leaders.

Von Braun and Medaris intended to take the opportunity to pitch the Army missile program and seek a bigger role for the Army. Such a pitch was not necessary, however, because right in the middle of the cocktail hour it was announced that the Russians had successfully launched SPUTNIK. Von Braun is said to have turned to McElroy and remarked, "when you get back to Washington and all hell breaks loose, tell them we've got the hardware down here to put up a satellite any time."<sup>63</sup> The next day Eisenhower ordered the Secretary of Defense to "get the Redstone people into the business of putting a satellite into orbit as soon as possible."<sup>64</sup> The launch of SPUTNIK, which confirmed the August 1957 Soviet claim of having an ICBM, also prompted Eisenhower to approve the continued development of JUPITER by ABMA. The Army delivered the first JUPITER IRBM to the Air Force for deployment on August 28, 1958.

More bad news came on November 3, 1957, with the launch of SPUTNIK II, which included with its 1,100-pound payload a dog named Laika. The American public was concerned about preparedness and the Soviet ability to launch heavy nuclear weapons on ICBMs. In response, Eisenhower created a panel to study the U.S. space program. In order to "to allay public fears," he made a major television address from the White House on November 7 on science and security.<sup>65</sup> Thanks to the Army, Eisenhower was able to announce some good news: ABMA scientists had made a "breakthrough" by successfully solving the problem of ballistic missile reentry. The RS-40 nose cone, recovered from the August 8 flight, was displayed as a trophy to the television audience. He also

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<sup>61</sup> Ambrose, p. 25.

<sup>62</sup> Breuer, p. 148.

<sup>63</sup> Ordway and Sharpe, p. 382.

<sup>64</sup> Breuer, p. 148.

<sup>65</sup> Rosholt, p. 7.



announced the appointment of James R. Killian, president of the Massachusetts Institute of Technology, as the Special Assistant to the President for Science and Technology. Another positive step was taken on November 8, when McElroy officially ordered ABMA to prepare a missile for launching a satellite into orbit as part of IGY.

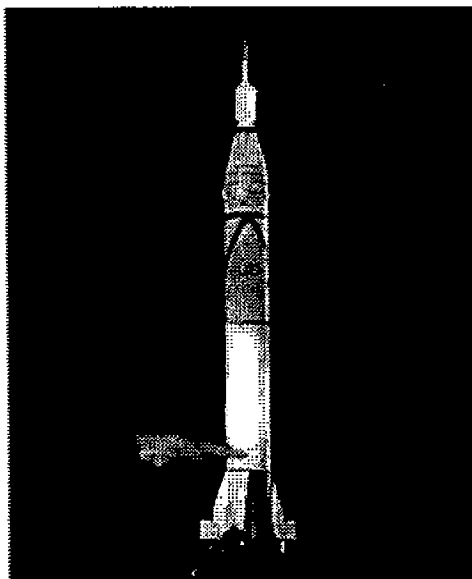


Figure 26. A Cold War Victory: the launch of the Free World's first satellite, January 31, 1958...

The American people desperately needed some good news. An excited public eagerly anticipated the December 5 launch date of VANGUARD. VANGUARD, Navy Test Vehicle 3 (T-3), was a three-stage rocket. It was designed to gain an altitude of 300 miles and an orbital velocity of 18,000 miles-per-hour. The *Project Vanguard* launch, however, was a dismal failure. T-3 toppled over on the test stand and exploded. Public emotions ran from severe disappointment to panic. Many considered it a national humiliation. The Soviet media laughed. The Martin Company, which built the VANGUARD engine, was hard hit financially. The board of governors of the New York Stock Exchange suspended trading of Martin stock the following day at 11:52 a.m. due to a rash of sell orders.<sup>66</sup> VANGUARD was finally launched March 17, 1958.

In the meantime, redemption came for the nation and the U.S. Army missile team on January 31, 1958. On this date, at 10:48 p.m., EXPLORER I left the launch pad at Cape Canaveral in the nose of one of ABMA's JUNO I rockets. Utilizing a modified JUPITER C vehicle, the Army launched the Free World's first satellite into orbit within 84 days of the official notice to proceed. EXPLORER I provided valuable scientific information. Dr. James A. van Allen, of Iowa State University, provided cosmic ray instrumentation, while the Army's Jet Propulsion Laboratory (JPL), located at California Tech, and the Naval Research Laboratory provided transmitters for tracking and telemetry for the 30-pound satellite.

### *The Army Leads America in the Space Race*

With the success of EXPLORER I, more responsibilities were given to the Army. ABMA was in the limelight. On February 17, 1958, von Braun appeared on the cover of



Figure 27. ... And Huntsville celebrates.

<sup>66</sup> Breuer, p. 151.

*Time* magazine. According to Hughes, "the Army embarked on an ambitious program which rapidly advanced U.S. interests and goals in the space arena."<sup>67</sup> ABMA, created solely for the military mission of developing an IRBM, received special orders for implementing a satellite program. It was authorized to launch additional EXPLORER



Figure 28. Von Braun on the cover of *Time*.

satellites into orbit on March 26, 1958; July 26, 1958; and October 13, 1959. Following the successful March 26 launch of the 31-pound EXPLORER III satellite, the Secretary of Defense assigned ABMA the launching of two lunar probes.

ABMA was placed within the newly-created Army Ordnance Missile Command (AOMC) on March 31, 1958. According to Joiner and Jolliff, "the creation of AOMC was an indication of the increasing importance of the missile field and the pressing necessity for exploiting resources to their maximum capabilities."<sup>68</sup> Medaris became the commanding officer of AOMC, the largest field organization within any of the Army technical services.

The special powers of the ABMA commanding officer were transferred to the AOMC commanding officer. Medaris was responsible for managing the R&D, production, storage, and maintenance of fifteen major missile weapon systems in Alabama, California, and New Mexico. AOMC included ABMA and the new Army Rocket and Guided Missile Agency (ARGMA) at Redstone Arsenal, JPL, White Sands Proving Ground (which was renamed White Sands Missile Range on May 1, 1958), and Redstone Arsenal. ARGMA, created April 1, 1958, assumed the technical missions held by Redstone Arsenal. Redstone Arsenal then became an organization responsible for post support and housekeeping functions.

As AOMC worked to develop rockets for launching space satellites, it also continued to develop more powerful and efficient means of delivering nuclear warheads. In order to find a replacement for the REDSTONE, the Army requested that the Department of Defense grant an exemption to the restriction that prevented the Army from developing missiles with ranges greater than 200 miles. The Army was interested in conducting research on a missile with a 500-mile range. With Department of Defense approval, AOMC began R&D in 1958 on what would become the PERSHING missile. Martin Marietta Aerospace of Orlando, Florida, was selected as the prime contractor. The PERSHING I was designed with a 400-mile range and a nuclear weapon capability. It had longer range and greater mobility than the REDSTONE. Testing of the PERSHING I began at White Sands Missile Range in February 1960, and it was first deployed in 1963. According to Gaither and Peter, the PERSHING missile "would become one of the most important missiles in the Army's arsenal."<sup>69</sup>

<sup>67</sup> Baker et al, *Pioneering Efforts in Space*

<sup>68</sup> Joiner and Jolliff, p. 79.

<sup>69</sup> Gaither and Peter, p. 25.

The Space Race heated up again when the Soviets launched SPUTNIK III and placed a satellite weighing almost 1.5 tons into orbit on May 15, 1958. This was another serious blow to America's pride. In response, national leaders began calling for the creation of a U.S. Department of Space. The launch of SPUTNIK III made the Soviets confirmed leaders in the Space Race, and lawmakers in Washington were deeply concerned. Von Braun went to Washington and testified before Congress about the Soviet's big rockets. The Pentagon considered the Soviet space program a serious threat to the security of the United States. Eisenhower's panel on the U.S. space program recommended that America "could best respond to the challenge imposed by Russia's successful orbiting of the world's first artificial earth satellite" by creating a civilian space agency.<sup>70</sup>

Eisenhower, however, was against creation of a civilian space agency. He considered the Space Race pathetic and a moon probe useless.<sup>71</sup> He finally succumbed to political pressure and, on April 2, 1958, called upon Congress to create the National Aeronautics and Space Administration (NASA). Congress responded by passing the National Aeronautics and Space Act of 1958. In urging the passage of the bill, Senator Lyndon B. Johnson of Texas said, "what we do now may very well decide, in a large sense, what our Nation is to be 20 years and 50 years and 100 years from now - and, of no lesser importance, our decisions today can have the greatest influence upon whether the world moves toward a millennium of peace or plunges recklessly toward Armageddon."<sup>72</sup>

America got its "missile czar" and a new civilian space agency when Eisenhower signed the NASA bill into law on July 29, 1958. NASA was given control of all space activities except those considered by the president to be primarily associated with national defense. NASA, an outgrowth of the National Advisory Committee for Aeronautics, a civilian agency created in 1915, grew rapidly by absorbing existing projects, programs, people, and installations. The *Project Vanguard* team and the Upper Atmosphere Sounding Rocket Group were among the first NASA acquisitions.

Despite the existence of NASA, the Army had an undisputed leadership role in the Space Race throughout 1958. At that time Redstone Arsenal was in the midst of a \$32 million construction program. Von Braun and his staff of Army scientists were working on a project, previously begun in April 1957, that would lead to SATURN, America's first rocket developed specifically for space exploration. They intended to design a launch vehicle capable of placing 20,000- to 40,000-pound payloads into orbit or lifting 6,000- to 12,000-pound payloads for missions leaving earth orbit -- the proposed booster would be capable of producing 1.5 million pounds of thrust. This ambitious program was submitted to the Department of Defense in December 1957 in an ABMA report entitled *Proposal for a National Integrated Missile and Space Vehicle Development Program*. Following the success of the SPUTNIKS, ABMA was authorized by the Advanced Research Projects Agency (ARPA) to work on the project. ARPA, the R&D arm of the

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<sup>70</sup> Rosholt, p. 3.

<sup>71</sup> Breuer, p. 155.

<sup>72</sup> U.S. Congress, Senate, Special Committee on Space and Astronautics, *National Aeronautics and Space Act, Hearings on S. 3609, Part I*, 85th Cong., 2nd sess., 1958, p. 6.

Department of Defense, was created February 7, 1958, with Roy Johnson of General Electric as director.

SATURN R&D officially began in August 1958 with funds from ARPA. The design of the first-stage booster, which consisted of a cluster of existing engines, was pure ABMA: a JUPITER propellant tank in the center encircled by eight REDSTONE tanks. It was fueled by kerosene and liquid oxygen and was designed to generate 1.5 million pounds of thrust. A TITAN rocket was the second stage, and a hydrogen-powered CENTAUR rocket comprised the third stage. The power of SATURN allowed the escape of a 14,000-pound payload from the earth's gravitational pull.

PIONEER III, the first of the ABMA lunar probes, was successfully launched on the new four-stage JUNO II rocket on December 6, 1958. It traveled 66,654 miles toward the moon before dropping back to earth after 38 hours of flight. Although it never made it to the moon, it was considered a success because of the data it provided on cosmic radiation. ABMA launched JUPITER AM-13 on December 13, 1958. This flight provided highly useful data for Army and Navy medical research on manned space flights because it carried a squirrel monkey as payload. Gordo, who has the distinction of being the first U.S. "monkeynaut," made the flight with no known adverse effects, but could not be recovered due to the failure of the nose-cone floatation device.

NASA began official operation on October 1, 1958, almost a year after the launch of SPUTNIK. Shortly thereafter, NASA requested the transfer of both JPL and ABMA space-related activities to its jurisdiction. JPL, whose functions and facilities had been part of the Army since 1945, was transferred to NASA in December 1958. Eisenhower deferred his decision on the transfer of ABMA. On December 3, 1958, the Army and NASA reached an agreement whereby AOMC and its subordinate organizations at Redstone Arsenal, primarily ABMA, would provide support to the NASA space program.

For the next 18 months AOMC was in the middle of the Space Race. The command had a 1959-1960 budget of \$2 billion, of which over 10 percent came from NASA and ARPA for space related missions.<sup>73</sup> Construction of the ABMA static test stand for large boosters, which would be used in the development of



Figure 29. A joint ABMA/JPL project under the direction of NASA, PIONEER IV, a lunar probe, was launched March 3, 1959.

<sup>73</sup> Joiner and Jolliff, p. 80.

SATURN, began January 10, 1959.<sup>74</sup> One week later von Braun received the Distinguished Civilian Service Medal, the highest award to civil servants, from Eisenhower.<sup>75</sup>

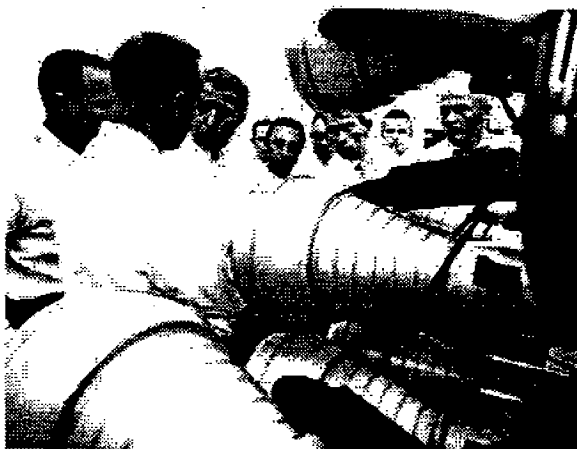


Figure 30. Von Braun with the *Project Mercury* astronauts at Redstone Arsenal, June 1959.

PIONEER IV, a joint ABMA/JPL project under the direction of NASA, was launched March 3, 1959. This second lunar probe achieved a velocity in excess of 24,560 miles per hour and passed within approximately 36,000 miles of the moon. PIONEER IV traveled on to become the first U.S. satellite in permanent orbit around the Sun.

On April 2, 1959, NASA selected seven astronauts for *Project Mercury*. NASA had begun organizing a program that would launch a man into orbit shortly after it began operations. This program was officially named *Project Mercury* on November 26,

1958. A modified REDSTONE rocket was selected as the launch vehicle. The *Mercury* astronauts visited von Braun and toured ABMA facilities in June 1959.

The Army was involved in a variety of studies on space exploration during this time. In May 1959 the Army completed a four-volume study on *Project Horizon*. It provided details for putting a manned outpost on the moon's surface by 1966. The flight of the monkeys Able and Baker occurred on May 28, 1959. This marked America's first successful recovery of living beings from outer space. The monkeys rode in the nose cone of JUPITER Missile AM-18 to an altitude of 300 miles and a distance of 1,500 miles. They successfully withstood 38 times the normal pull of gravity and a weightless period of about nine minutes. Their



Figure 31. Press conference with "monkeynaughts" Able and Baker, May 1959.

<sup>74</sup> David S Akens, *An Illustrated Chronology of the NASA Marshall Center and MSFC Programs, 1960-1973* (Huntsville, Ala.: Historical Staff, Management Services Office, George C. Marshall Space Flight Center, National Aeronautics and Space Administration, 1974).

<sup>75</sup> Ordway and Sharpe, p. 387.

survival of speeds over 10,000 miles per hour was an important step toward putting a man into space. ARPA representatives met with ABMA staff in July 1959 to discuss studies on a Maneuverable Recoverable Space Vehicle (MRSV), the forerunner of the Space Shuttle. In October 1959 ABMA provided NASA with an interim report on lunar exploration using the SATURN system.

JUNO II (AM-19A) was launched on October 13, 1959. This ABMA vehicle successfully placed into orbit EXPLORER VII, the fourth satellite launched by the Army and the last of America's IGY satellites. Containing seven experiments, this satellite focused on the study of cosmic radiation and was designed to extend the knowledge of outer space. EXPLORER VII, according to the head of the U.S. Weather Bureau, opened a new era in global meteorology.

It is ironic that the significant success of the Army's space program resulted in its removal from Army control. On October 21, 1959, Eisenhower approved the transfer of ABMA's Development Operations Division, the core of ABMA's personnel, facilities, and missions, to NASA. Von Braun headed this division, which comprised over 70 percent of the ABMA workforce. Due to the high level of expertise in the Army missile program and the desire to build the best staff possible at NASA, Eisenhower decided it was in the nation's best interest to transfer the Army's space-related assets. The Army-NASA Transfer Plan, signed by the NASA Administrator, Secretary of the Army, and acting Secretary of Defense on December 16, 1959, allowed NASA to establish an independent space vehicle R&D center at Redstone Arsenal. The plan relegated ABMA to conducting R&D on missile weapons systems with a small fraction of its previous assets.

Transfer of the technical direction of the SATURN booster program from the Army to NASA began in November 1959, pending the official transfer on March 15, 1960. In the interim, the Army agreed to continue working for the civilian agency under the December 1958 agreement. On January 18, 1960, SATURN received a DX rating. It was approved as a project with the highest national priority. ABMA conducted the first static firing of all eight SATURN booster engines on April 29, 1960. The successful test lasted for 8.07 seconds.

As part of its continuing military mission, ABMA successfully launched JUPITER AM-30, the final R&D variant of the missile, on February 4, 1960, from Cape Canaveral. Of the 29 missiles tested under this program, only two were failures. Shipments of the missiles began in July 1960, and by March 5, 1962, the last of the 45 missiles, deployed in Italy and Turkey, became operational.

#### *NASA Takes Over*

NASA's George C. Marshall Space Flight Center (MSFC) was created at Redstone Arsenal by an Executive Order of March 15, 1960. The formal activation of MSFC, on July 1, 1960, marked the end of the Army's pioneering efforts in outer space. MSFC was assigned the task of supporting the national program for the exploration of space and was specifically responsible for R&D on large launch vehicles and rocket propulsion systems.

With the creation of MSFC, which consisted entirely of ABMA assets at Redstone Arsenal, the Army abruptly lost the national leadership role it had held in the Space Race for two and a half years. Over 1.5 million square feet of space and approximately 5,000 ABMA personnel, including von Braun and 89 of the remaining *Operation Paperclip* scientists, were transferred to NASA. ABMA retained 300 scientific and engineering personnel. Army land was leased to NASA and almost all ABMA buildings were placed in NASA control. The transfer included \$100 million in facilities and equipment at Redstone Arsenal and Cape Canaveral, Florida.<sup>76</sup> Eisenhower formally dedicated the "new" NASA space flight center at Redstone Arsenal on September 8, 1960, with von Braun as its first director.

Directorship of MSFC was a dream come true for von Braun, who had wanted to work solely on the development of large rockets for space travel all his life. He did not even have to move his desk: Building 4488 which contained his office, continued to serve as joint headquarters for what remained of ABMA and the new MSFC. Von Braun and his team were tasked to develop an efficient and reliable means of lifting multi-ton loads into orbit and into deep space. They continued work on the SATURN rocket under the auspices of NASA.

Of all the NASA acquisitions, von Braun and the Army scientists from ABMA proved to be among the most valuable. According to Toftoy, "the greatest single value of the [*Operation Paperclip*] group was their collective experience as a team over many years. Their technical ability coupled with the most practical approach, their thoroughness and attention to minute detail, plus their 20 years of experience, gives them the edge over other groups today regardless of their size or technical competence."<sup>77</sup> ABMA was the nation's leading organization for guided missile R&D in the Free World. The men from that agency would be instrumental in placing a man on the moon less than a decade later.

As the launch-vehicle development center for NASA, MSFC was responsible for R&D of JUNO II, MERCURY-REDSTONE, and CENTAUR launch vehicles; the AGENA-B stage for ATLAS and THOR missiles; supervision of the F-L single engine program; and development of the SATURN C-1, C-2, and C-3 programs. Although the Army lost its space-related missions, it continued to participate in NASA space missions for the next couple of years. The Army also provided modified REDSTONES for NASA's use in *Project Mercury*.

The REDSTONE was a wise choice for launch vehicle because it was reliable and aerodynamically stable. In the event of engine failure during ascent, crew recovery was possible because the capsule could be separated from the missile. If an unstable missile failed, however, tumbling could not be avoided and the crew would be lost.<sup>78</sup> On

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<sup>76</sup> Robert A. Smith, III, and James M. Grimwood, *The Background and Philosophy of Ballistic Missile Research* (Redstone Arsenal, Ala.: Reports and Historical Branch, Army Ordnance Missile Command, 1962).

<sup>77</sup> Toftoy and Hamill, p. 6.

<sup>78</sup> Stuhlinger 1959

December 19, 1960, a MERCURY-REDSTONE (MR-1A) boosted a one-ton MERCURY capsule 135 miles high and 235 miles down the Atlantic Missile Range. A MERCURY-REDSTONE (MR-2), launched January 31, 1961, successfully carried a 37-pound chimpanzee named Ham to an altitude of 155 miles and a distance of 420 miles. This sub-orbital flight helped prove the system's operational capabilities in a space environment.

The U.S.S.R. leapt ahead in the Space Race on April 12, 1961, when they put the first man, Yuri A. Gagarin, a Soviet Air Force major, into orbit. He circled the earth in the 10,395-ton VOSTOCK I. America was once again stunned by a significant Cold War defeat. In a telephone call to Gagarin, Soviet Premier Nikita Khrushchev said, "let the capitalist countries catch up with our country!" The Soviet newspaper *Pravda* wrote, "in this achievement are embodied the genius of the Soviet people and the powerful force of communism . . . the Gagarin flight was evidence of the virtues of victorious socialism . . . evidence of the global superiority of the Soviet Union in all aspects of science and technology."<sup>79</sup>

The first American manned space flight occurred on May 5, 1961, when Commander Alan B. Shepard, Jr., rode a MERCURY-REDSTONE (MR-3) into a 15-minute sub-orbital flight. His 2,800-pound capsule reached an altitude of 115 miles and landed in the Atlantic Ocean 302 miles from Cape Canaveral. The last MERCURY-REDSTONE mission, also a manned sub-orbital flight, carried Captain Virgil I. Grissom to an altitude of 118 miles and a distance of 303 miles. Lieutenant Colonel John H. Glenn became the first American astronaut to orbit the earth on February 20, 1962.

During the 1960s MSFC and its staff of former Army scientists developed the highly significant SATURN system of launch vehicles. SATURN I was used to launch PEGASUS meteoroid detection satellites. SATURN I-B was used for APOLLO spacecraft development and orbital maneuvers and for the SKYLAB and APOLLO-SOYUZ Test Project missions. SATURN V was used as the launch vehicle for earth orbital missions, mankind's first trip to the moon, and the first American space station, SKYLAB.

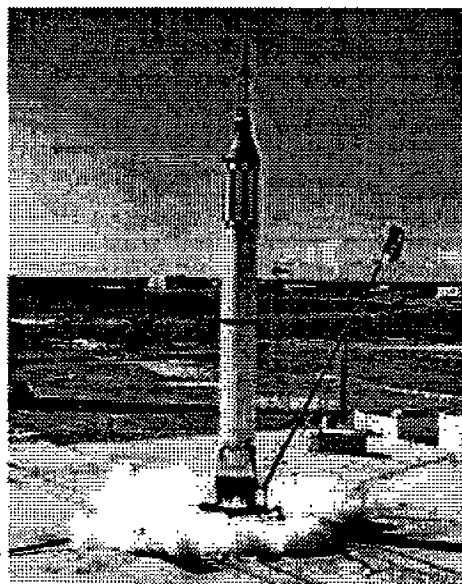


Figure 32. The launch of Commander Alan B. Shepard, May 5, 1961, on a MERCURY-REDSTONE rocket.

Von Braun fully credited the Army organizations at Redstone Arsenal for establishing the foundation for America's ultimate predominance in the exploration of space. Von Braun officially acknowledged the Army's contributions shortly after his transfer to NASA

<sup>79</sup> Breuer, p. 163.



offices in Washington, D.C. In a letter dated April 7, 1970, he writes to Major General Edwin I. Donley, commander of U.S. Army Missile Command:

Please let me emphasize that without the continuous and great help of the U.S. Army elements at Redstone-- and their highly capable and versatile personnel--the Marshall Center and our national space program would not be where they are today . . . I am happy to once again express my deep appreciation for the many substantial opportunities that the U.S. Army has afforded me during my long years of association with it and its splendid members.

### 3.3.3 An Intermediate Threat: 1961-1989

Following the creation of MSFC and the loss of the Army's space mission, Army personnel at Redstone Arsenal continued working on the R&D of missile weapon systems. By 1960, however, there was a growing movement in the government to avoid competition with industry. It became official policy that the government should not produce anything that could be manufactured by private companies. The R&D role of arsenals was significantly reduced by the "weapon system" concept, which dictated that prospective manufacturers should perform R&D. According to Shiman, "by 1958, 90 percent of the Army's R&D was already being performed by industry."<sup>80</sup> With the transfer of ABMA staff, the remaining R&D at Redstone was mostly in the hands of defense contractors.

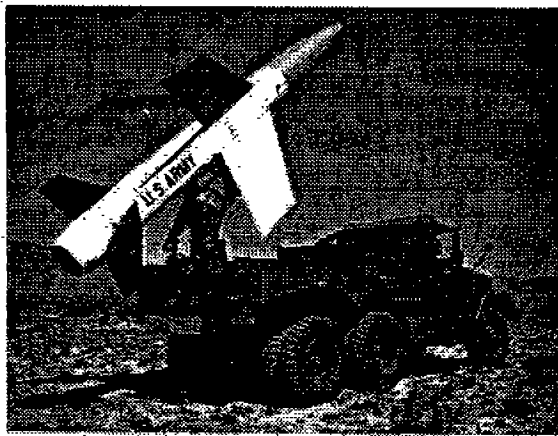


Figure 33. LACROSSE missile (1961).

Prior to the creation of MSFC, ABMA consisted of 5,678 employees responsible for the REDSTONE, JUPITER, and PERSHING missile systems. They also worked on projects for NASA and ARPA projects. ARGMA, with 3,376 people, worked on the CORPORAL, SERGEANT, HONEST JOHN, LITTLEJOHN, Missile A, Missile B (later LANCE), NIKE ZEUS, NIKE AJAX, NIKE HERCULES, Field Army Ballistic Missile Defense System (FABMDS), HAWK, MAULER, REDEYE, LACROSSE, SHILLELAGH, SS-10/11, and various target missiles. Redstone Arsenal's 4,630 people furnished administration, security and

safety operations, training, and logistic services to its tenants. Staff members at AOMC, numbering 629, administered these subordinate elements.<sup>81</sup>

<sup>80</sup> Shiman, p. 71.

<sup>81</sup> Elizabeth C. Jolliff, *History of the U.S. Army Missile Command: 1962-1977* (Redstone Arsenal, Ala.: U.S. Army Missile Command, Historical Division, 1979), pp. 4-5.

Following the NASA transfer it was necessary for AOMC to reorganize ABMA and ARGMA. In order to even the workload, AOMC realigned its management missions between the two agencies. ARGMA was responsible for air and space defense missile systems and battlefield guided weapons with post-launch control. ABMA was responsible for pre-programmed/surface-to-surface missile systems. ABMA continued to provide support to NASA and ARPA and to work on the REDSTONE, JUPITER, and PERSHING missiles. It also received control of CORPORAL, SERGEANT, HONEST JOHN, LITTLEJOHN, Missiles A and B, and the LAW from ARGMA. ARGMA

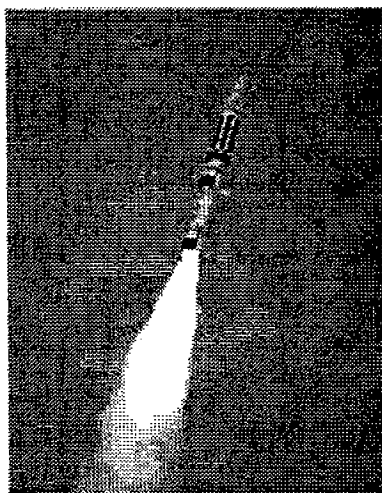


Figure 34. First launch of the PERSHING I, February 25, 1960, at White Sands Missile Range.

retained control of NIKE ZEUS, NIKE AJAX, NIKE HERCULES, FABMDS, HAWK, MAULER, REDEYE, LACROSSE, SHILLELAGH, SS-10/11, and the target missile systems. As part of the reorganization, 104 guided missile technicians were transferred from Raritan Arsenal, New Jersey, to Redstone Arsenal in August 1960. ARGMA received 97 of the technicians while ABMA received seven.

ABMA and ARGMA ceased to exist when they were consolidated into AOMC in December 11, 1961. An overall reorganization occurred in the U.S. Army in 1962. The "technical branches," which included such organizations as the Ordnance Department, Chemical Warfare Service, Quartermaster Corps, and Signal Corps, were consolidated into one organization, U.S. Army Materiel Command, on August 1, 1962. Part of this reorganization included the discontinuation of AOMC and the activation of U.S. Army Missile Command (MICOM).

JUPITER missiles played an important role in the Cuban Missile Crisis of October 1962. This significant event, which is considered the closest the U.S. and U.S.S.R. came to turning the Cold War into a hot war, occurred when the U.S. discovered Soviet SS-4 missile bases under construction in Cuba. The U.S. established a sea and air blockade of Cuba and demanded that the bases be dismantled. At that time the U.S. IRBM force included THOR missiles in England and JUPITERs deployed in Italy and Turkey.

Some experts speculate that had there not been JUPITERs in Turkey, there would have been no Cuban Missile Crisis. According to Philip Nash in *The Other Missiles of October: Eisenhower, Kennedy, and the Jupiters, 1957-1963*,

... in explaining Khrushchev's motives for deploying missiles in Cuba, it would be erroneous to assign greatest importance to the Turkish Jupiters. Although the necessary Soviet sources are not yet available, the best accounts agree that Khrushchev's decision stemmed from both his

understandable fears for the survival of Castro's Cuba and his equally understandable anxiety over Soviet strategic inferiority, which U.S. officials has repeatedly publicized since the previous fall. The Jupiters in Turkey did, however, serve as a secondary motive and as an important, if not decisive, catalyst for Khrushchev's decision.<sup>82</sup>

Nash goes on to quote Khrushchev as saying, in reference to the missiles in Cuba, "[The Americans] would learn just what it feels like to have enemy missiles pointing at you; we'd be doing nothing more than giving them a little of their own medicine." The Soviets were angered by the deployment of American nuclear weapons so close to home. While attending a reception in Ankara, Turkey, on October 23, 1962, the Soviet ambassador to Turkey, Nikita Ryzhov, told Turks that the Soviet Union "considered Turkey its 'Cuba,'" and that the Turkish bases "were just as menacing as anything in Cuba."<sup>83</sup>

On October 27, 1962, Attorney General Robert F. Kennedy and Soviet ambassador Anatoly Dobrynin concluded an explicit trade: SS-4s would be withdrawn from Cuba for the removal of JUPITERS from Turkey and Italy. According to Nash, this deal, at the time known only to two U.S. policymakers besides the Kennedys, "helped defuse the most dangerous crisis of the Cold War."<sup>84</sup> This swap was significant because it was, in essence, the first arms reduction agreement between the U.S. and U.S.S.R. Although it was "verbal, informal, secret, spontaneous, sequential, unevenly verified, and subsumed under a larger tacit agreement," it was the "first agreement in the history of the arms race under which both sides dismantled a portion of their operational nuclear delivery systems."<sup>85</sup>

Systems developed, deployed and supported by MICOM during the early 1960s included the CHAPPARAL, DRAGON, Improved HAWK, Self-propelled HAWK, LANCE, PERSHING I, PERSHING Ia, REDEYE, SERGEANT, SHILLELAGH, TOW, and Airborne TOW. Systems already deployed which came under MICOM management in 1962 included NIKE AJAX, CORPORAL, LACROSSE, LITTLEJOHN, REDSTONE, SS-10, SS-11, and ENTAC. Systems transferred to MICOM in 1962 that were still operational in 1977 were the Basic HAWK, HONEST JOHN, LAW, NIKE HERCULES, the 2.75-inch Rocket System, and target missiles. Systems that began under MICOM management included the General Support Rocket



Figure 35. Shoulder-launched STINGER missile.

<sup>82</sup> Philip Nash, *The Other Missiles of October: Eisenhower, Kennedy, and the Jupiters, 1957-1963* (Chapel Hill, N.C.: University of North Carolina Press, 1997), p. 106.

<sup>83</sup> *Ibid.*, p. 137.

<sup>84</sup> *Ibid.*, p. 142.

<sup>85</sup> *Ibid.*

System, High Energy Lasers, HELLFIRE, PERSHING II, Precision Laser Designators, U.S. ROAND, STINGER, and VIPER. MICOM was in existence for 15 years. On January 31, 1977, MICOM was divided into U.S. Army Missile Research and Development Command (MIRADCOM) and U.S. Army Missile Materiel Readiness Command (MIRCOM). In 1979 these commands merged back into MICOM.

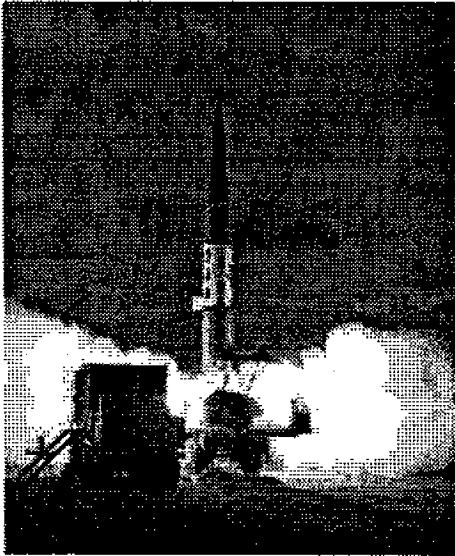


Figure 36. PERSHING Ia test launch, March 1, 1968.

Of the weapons developed by MICOM, the PERSHING I, PERSHING Ia, and PERSHING II had the greatest strategic value. The PERSHING missile was a vital part of America's Cold War nuclear arsenal for thirty years. Development of this IRBM was initially assigned to ABMA in 1958. Much of the actual R&D of the missile was contracted out to the Martin Marietta Aerospace.<sup>86</sup> The solid-propellant PERSHING I was conceived as a replacement for the liquid-fueled REDSTONE as a nuclear threat. MICOM began deploying the PERSHING I in August 1963. The PERSHING Ia began replacing PERSHING I in 1969. The newer system provided increased reliability and flexibility, additional ease of maintenance, lower mission cost, and enhanced operational time.

Feasibility studies for development of the PERSHING II began in 1973, and authorization for the advanced development of the PERSHING II occurred in 1974. Martin Marietta was again selected as the prime contractor. President Jimmy Carter assigned the PERSHING II program DX priority, the highest national priority granted to a weapons system, in February 1980. The production phase of the new missile began in December 1981. The PERSHING II was first deployed in December 1983.

This new system, which figured prominently in the arms race, utilized a terminally guided reentry vehicle with a new warhead, new propulsion sections, and modified PERSHING Ia ground support equipment. The PERSHING II provided increased effectiveness by covering longer ranges with greater accuracy. The range and accuracy of the PERSHING II were major factors in the Soviet Union's decision to seek the Treaty on Intermediate Range Nuclear Forces (INF Treaty), which became effective June 1, 1988.

The INF Treaty was historic because it resulted in the elimination of an entire class of nuclear missiles, the IRBM. The INF Treaty provided for the elimination of the U.S. Air Force's Ground Launched Cruise Missiles (GLCMs) and the U.S. Army's PERSHING II missile stages, launchers, trainers, and deployed reentry vehicles by May 31, 1991. All

<sup>86</sup> Gaither and Peter, pp. 93-94.

PERSHING Ia missiles had to be eliminated within 18 months of the treaty's effective date. The historic treaty covered a total of 169 PERSHING Ia missiles and 234 PERSHING IIs.<sup>87</sup>

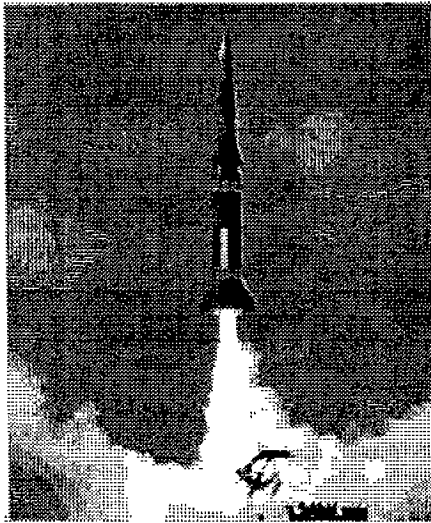


Figure 37. PERSHING II missile.

Most of the PERSHING missile stages were static fired and then crushed at either Longhorn Army Ammunition Plant or Pueblo Depot Activity. Representatives from both the Soviet Inspection Team and the U.S. On-Site Inspection Agency were present during the elimination process. The launchers were disassembled and major components were cut in half at either Pueblo Depot Activity or the Equipment Maintenance Center-Hausen (an activity of the Mainz Army Depot) near Frankfurt, Germany.

The Berlin Wall fell and the Cold War ended as historians from both sides planned to commemorate the INF Treaty by displaying the weapons it banned. Each side was allowed to disable 15 missiles and launchers for permanent exhibition in museums and similar facilities. The

U.S. selected the Army's PERSHING II and the Air Force's GLCMs. PERSHING II missiles and launchers were put on display at the Field Artillery Museum, Fort Sill, Oklahoma; White Sands Missile Range; the Eastern Test Range at Cape Canaveral; and the U.S. Space and Rocket Center at Huntsville. A missile was exhibited also at Langley Air Force Base in Hampton, Virginia. Two PERSHING II missiles and a launcher were donated to the Smithsonian Institution's Air and Space Museum. One of the PERSHING IIs was traded to Russia for an SS-20 missile.

In the closing years of the Cold War, scientists at Redstone Arsenal also played a role in the Strategic Defense Initiative (SDI). Introduced by President Ronald Reagan in 1983, SDI was planned as a ballistic missile defense system that would serve as a shield to prevent nuclear missiles from reaching U.S. targets. According to Gaither and Peter, "the research demands for SDI were immense," with many different participants spread throughout the country.<sup>88</sup> It required many technologies that did not exist, such as a sensor system capable of tracking over 10,000 warheads, powerful lasers and particle beams, and computer software for coordinating the large system.

Between 1983 and 1985, SDI emerged as the Pentagon's "largest single research and development project."<sup>89</sup> The SDI Office was created in 1984 to oversee the project and

<sup>87</sup> U.S. Army Missile Command, *Pershing: Mission Complete—Retired With Honor*, brochure prepared for the Final Elimination of Pershing II Weapon System at Longhorn Army Ammunition Plant, Texas (Redstone Arsenal, Ala.: Historical Division, U.S. Army Missile Command, 1991).

<sup>88</sup> Gaither and Peter, p. 130.

<sup>89</sup> *Ibid.*

coordinate efforts of the Army Strategic Defense Command (ASDC), the Air Force Electronics Division, the Naval Research Laboratory, ARPA, and the Defense Nuclear Agency. ASDC was created out of the Ballistic Missile Defense Organization (BMDO), which was located at Redstone Arsenal, in July 1985. The U.S. Army received over half the funding appropriated to SDI. Army organizations receiving the appropriations were the Army Materiel Command Research and Development Center at Picatinny Arsenal, Army Materials and Mechanics Research Center at Watertown Arsenal, and BMDO. Located at Redstone Arsenal, the U.S. Army Space and Missile Defense Command and MICOM's Army Research Development Engineering Center were also involved with SDI.

The bulk of R&D on SDI was conducted by private companies and institutions. The Army administered over 2,600 research contracts. It also contributed work from laser weapons research at the Frankford Arsenal Optical Laboratory, data from laser test facilities of the Army Electronics Command, and research from the Pulse Power Laboratory at Fort Monmouth. Previous research from the Ballistic Missile Defense Advanced Technology Center at Redstone Arsenal was also used. The Endoatmospheric Non-nuclear Kill Program served as a basis for the development of the High Endoatmospheric Defense Interceptor of SDI.

As the Cold War came to an end, funding for SDI was dramatically reduced. In 1987 the SDI Office planned to request \$8 billion in funds for fiscal year 1991. With SDI as a low national priority in the late 1980s, they eventually requested only \$4.66 billion. They were granted only \$2.9 billion. In 1991 President George Bush redirected R&D effort from SDI to Global Protection Against Limited Strikes (GPALS).

Although Redstone Arsenal had a limited role in SDI, its involvement was reminiscent of the beginning of the Cold War, when Army personnel at Redstone played a major leadership role in the Space Race and Nuclear Arms Race. According to Gaither and Peter, SDI "served to reinvigorate the search for and development of *new* technologies that flourished at – and defined – the beginning of the Cold War."<sup>90</sup>

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<sup>90</sup> Ibid.

## 4.0 RESOURCE EVALUATION

### 4.1 Historic Context

#### 4.1.1 The Cold War: 1946 -1989

Redstone Arsenal was host to many important people, events, and programs during the Cold War, but few should be considered exceptionally important within the Cold War historic context. *Rocket Science* identifies and assesses properties with the greatest likelihood of being eligible for the National Register of Historic Places (NRHP). As mentioned in the *Methodology* section of this report, due to the age requirements of the NRHP most of the Cold War era buildings at Redstone Arsenal would have had to have gained "exceptional importance" within the past 50 years to be considered NRHP eligible. Army, Air Force, and Department of Defense (DOD) guidelines were used in determining which Cold War resources at Redstone Arsenal should be considered exceptionally important. These guidelines helped establish a Cold War historic context within which the Redstone Arsenal resources were evaluated.

*Coming in From the Cold* stipulates that support structures, such as barracks, family housing, commissaries, administrative buildings, recreation facilities, garages, maintenance shops, utilities, and infrastructure, should not be considered potentially NRHP eligible under Criteria Consideration G as Cold War properties. Such facilities were, therefore, excluded from this study. Army and Air Force guidelines recommend that focus be directed "specifically on operational missions and equipment of unmistakable national importance and a *direct*, not merely temporal, Cold War relationship."<sup>91</sup>

Resources were considered for potential eligibility under Criteria Consideration G in accordance with their Cold War significance. Research and development (R&D) facilities were ranked as the most important of the Cold War resources evaluated in *A Systemic Study of Air Combat Command Cold War Material Culture*. Therefore, *Rocket Science* focuses on the missile R&D facilities at Redstone Arsenal. They were considered much more likely to be NRHP eligible than any other type of resource. Facilities used for communications, weapon systems and support, material production, and training were regarded as low probability resources. According to *Looking Between Trinity and the Wall*, "the property type including research and development facilities is perhaps the most important property type for Cold War resources," and "research and development facilities are extremely important as a class because they were the resources through which the drive for new weapons and new technology was channeled."<sup>92</sup>

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<sup>91</sup> U.S. Department of the Air Force, Center for Air Force History, p. 69.

<sup>92</sup> Gaither and Peter, p. 140.

Through their associations with the Nuclear Arms Race and Space Race, some historic resources at the post qualify as Cold War properties under criteria established by the U.S. Army. As mentioned earlier in this report, the Army criteria requires that the resource:

- 1) Was constructed or used between March 1946 and November 1989 in order to:
  - Meet a specific real or perceived Soviet military threat; or
  - Project force designed to influence Soviet objectives and policies; or
  - Carry out major national objectives and policy toward the Soviet Union; or
  - Affect global opinion of the relationship between the superpowers.
- 2) Through its architectural or engineering design, clearly reflects one or more primary themes of the Cold War period.
- 3) Directly relates to the U.S./Soviet relationship through association with a milestone event of the period.
- 4) Directly relates to the U.S./Soviet relationship through association with the life of an exceptionally significant figure during their period of contribution.
- 5) Not normally considered a Cold War property, but an integral contributing part to a Cold War historic district and fundamental to the understanding of the district as a whole.

The guided missile R&D facilities at Redstone Arsenal meet these criteria.

Of the six Army-specific Cold War themes provided by Army guidelines, R&D facilities at Redstone Arsenal relate to "Mission Focus" and "Militarizing of Space." "Mission Focus" pertains to "continental air defense, adaptation of conventional forces for the use of tactical nuclear weapons, and the defense of Europe as part of the North Atlantic Treaty Organization (NATO)," which were new Cold War challenges faced by Army.<sup>93</sup> The first tactical nuclear missile batteries were outfitted with REDSTONE rockets, and R&D of the NIKE missiles, part of America's first continental air-defense missile system, occurred at Redstone. REDSTONE, JUPITER, and PERSHING rockets, which were designed at Redstone Arsenal, were deployed in Europe to defend NATO countries from the Soviet Union.

In regards to the "continental air defense" challenge, the NIKE AJAX, NIKE HERCULES, and NIKE ZEUS anti-aircraft missiles designed at Redstone Arsenal during the 1950s were significant as part of an enormous network that defended America against the Soviet Union's strategic nuclear bomber force. An early warning system, communications facilities, and missile battery emplacements were strategically located

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<sup>93</sup> U.S. Department of the Army, Director of Environmental Programs, pp. 24-25.



across the U.S. The R&D of the NIKE missiles that occurred at Redstone Arsenal, however, does not adequately convey the significance of the overall system. A NIKE emplacement, such as the one on New Jersey's Sandy Hook Peninsula, is a better resource for illustrating the exceptional importance of this system. NIKE Battery NY-56, located at Fort Hancock, is listed on the NRHP.

The missiles of Redstone Arsenal played a major role in the adaptation of conventional forces to the nuclear Cold War battlefield. Mobile REDSTONE and CORPORAL missile batteries were important parts of the Pentomic Army. The missile R&D that occurred at Redstone Arsenal does not, in and of itself, adequately convey the complexities of the Pentomic Army, which is discussed in greater detail below.

REDSTONE and JUPITER missiles are part of the Army's "Mission Focus" Cold War theme because they were used to defend NATO countries. These large, liquid-fuel surface-to-surface missiles were key strategic weapons that underwent R&D at Redstone Arsenal. The early variants of each type were designed, constructed, and tested in Huntsville by U.S. Army personnel. The JUPITER and REDSTONE missiles should be considered exceptionally important within the U.S. Army's Cold War historic context because these nuclear weapons were among the most potent offensive threats to the Soviet Union in the late 1950s and early 1960s. JUPITERs deployed in Italy and Turkey were diplomatic bargaining chips at the center of the Cuban Missile Crisis. According to Nash:

Despite their brief existence and little known place in the history of the U.S. nuclear arsenal, the Jupiters caused major diplomatic headaches for Presidents Dwight D. Eisenhower and John F. Kennedy. The missiles were a knotted thread connecting two of the most important events in the Cold War: the launch of the Soviet space satellite *Sputnik* and the Cuban missile crisis. Their deployment was a major NATO defense policy that repeatedly demanded the involvement of top U.S. officials, from the president on down.<sup>94</sup>

REDSTONE and JUPITER missiles served as vital deterrents until the deployment of intercontinental ballistic missiles (ICBMs) in the early 1960s.

The PERSHING missile system was also used to defend NATO countries during the Cold War. It was superior in quality to that of the REDSTONE and JUPITER systems. The PERSHING I was first deployed in 1963, after the deployment of the Air Force's ICBMs and the Navy's submarine-launched POLARIS missile. The PERSHING I was, therefore, not as vital a weapon in America's Cold War nuclear arsenal and should not be considered exceptionally important. It should be noted also that although program management of PERSHING occurred at Redstone Arsenal, the prime contractor conducted a majority of R&D. This was in accordance with new government policies meant to implement the "weapon system" concept, which dictated that prospective manufacturers should perform R&D.

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<sup>94</sup> Nash, p. 2.

The exceptional importance of the PERSHING II missile, as it relates to this Cold War historic context, is its *destruction* rather than its *development*. Its significance is not related to R&D. Project management occurred at Redstone Arsenal while Martin Marietta, Inc., the prime contractor, conducted most of the R&D for PERSHING II.<sup>95</sup> This missile is considered exceptionally important because of its role in bringing about the Intermediate Range Nuclear Forces (INF) Treaty in 1988. Elimination of the PERSHING missile system was a key provision of this disarmament treaty. Sites where the missile was destroyed best represent its significance. One such site, located at Longhorn Army Ammunition Plant, has been placed on the NRHP.

Out of all the Army's Cold War themes Redstone Arsenal fits most aptly into "Militarizing of Space." As demonstrated in the *Historical Overview* of this report, the main focus of Army efforts in the Space Race and Nuclear Arms Race was at Redstone Arsenal. During the 1950s the U.S. Army led the nation in the development of guided missiles for space exploration and nuclear war, and a majority of the research, design, testing, and initial production was accomplished in Huntsville.

Resources pertaining to the Nuclear Arms Race and Space Race at Redstone Arsenal should be considered exceptionally important because they (1) embody at least one of the Army's six Cold War themes, (2) are worthy of description using such adjectives as outstanding, notable, extraordinary, rare, superior, and uncommon, (3) contain information absolutely vital to understanding U.S./Soviet relations during the Cold War, (4) display the highest level of importance attainable within its historic context when compared to similar properties, and (5) have national or global significance.<sup>96</sup> As per Murphey's criteria, the resources associated with Redstone's guided missiles should be considered exceptionally important because they "vividly illustrate a key aspect of the progression from ideology to policy to military endeavor," and they "do so in a direct, clear fundamental manner obvious to a general audience with minimal understanding of the Cold War context."

Furthermore, these properties possess symbolic, technological, and social values of exceptional significance. The activities in these buildings focused on the "the protection of the American citizenry through a technological imperative arising from fear and mistrust of the Soviet Union." The guided missiles at Redstone Arsenal "were the diplomatic and political weapons used to fight the Cold War . . ." These rockets were not only engineering achievements, they were symbols "having social impacts that echoed throughout American life."<sup>97</sup>

The American public carefully watched the activities of the rocket scientists at Redstone Arsenal throughout the 1950s. The missiles that were developed in Huntsville had tremendous societal effects. The ability of the U.S. to field a nuclear missile or launch a satellite into orbit or send a man to the moon went beyond the mere technological or

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<sup>95</sup> Gaither and Peter, p. 95.

<sup>96</sup> Department of the Army, Director of Environmental Programs, p. 44-45.

<sup>97</sup> Karen Lewis et al., pp. 10-11.

utilitarian advantage – to accomplish these feats effected the ongoing propaganda war between America and Russia. A psychological defeat during the Cold War could be almost as dangerous as a battlefield defeat because the Cold War was, in large part, a psychological war. The Space Race and the Nuclear Arms Race were important contests between the U.S. and U.S.S.R. in which they fought for the hearts and minds of the world.

#### 4.1.2 An Army Context for the Cold War

According to most Cold War historians, one of the most important battles waged between the U.S. and U.S.S.R. during the Cold War was the development of new technologies. R&D had a high level of significance because it was the means to better weapon systems. The Cold War was waged, to a large degree, in the laboratory and on the proving ground. Each side wanted to have the technological advantage in case the Cold War got “hot.” Large appropriations were required to fund the R&D and production of increasingly complex and sophisticated weaponry. America was able to win the Cold War, in part, because it was able to sustain the enormous spending levels required. In contrast, the economy of the U.S.S.R. could not withstand such rigorous expenditures. The U.S. Army technical services, which included the Ordnance Department, were merged into Army Materiel Command (AMC) in 1962. Responsible for developing new and better weapons for the Army, AMC and its predecessor organizations were on the front line of the Cold War.

Gaither and Peter examine the Cold War context of AMC in *Looking Between Trinity and the Wall*. They identify the most important themes of the Cold War as “nuclear warfare, chemical and biological warfare, missile and space-related development, technology base development, and activities related to intelligence gathering, surveillance, and communications.”<sup>98</sup> They divide the Cold War into eras of Army growth and development, noting that the Army focused its resources on the creation of new technologies from the end of World War II to the mid-1960s. These new technologies included guided missiles and complex electronics equipment. From about 1965 to 1980 the Army concentrated on the refinement of existing weapons. After 1980 there was resurgence in new R&D:

During the final years of the Cold War there was a return to the development of new technology, this time related to the Strategic Defense Initiative [SDI] and its component systems like high-energy laser and particle beams, sensing systems capable of distinguishing offensive missile launches and decoy reentry vehicles, and hardware and software complex and reliable enough to control the new equipment. This renewed accent on high technology development was extremely expensive, and as such played a role in bringing about an end to the Cold War.<sup>99</sup>

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<sup>98</sup> Gaither and Peter, p. 140.

<sup>99</sup> Ibid, pp. 59-60

Redstone Arsenal is identified in *Looking Between Trinity and the Wall* as a significant Army installation during the initial period of technological revolution, from 1945 to 1963. Although several agencies at Redstone Arsenal participated in the development of SDI technologies in the 1980s, it is not identified as an important post during this period. As noted in the *Historical Overview*, funding for SDI was divided between the Army, Air Force, and Navy. Although the Army received half the appropriations for SDI, companies and institutions conducted most of the SDI R&D. Although agencies at Redstone Arsenal made some contributions to SDI, these contributions are very insignificant when compared to the level of work conducted in guided missile R&D at Redstone Arsenal in the 1950s.

Gaither and Peter identify Redstone Arsenal as one of the four most important Army posts from 1945 to 1949 because it was activated as the center for Army missile R&D in 1949. It was during this period that the groundwork for the Cold War was initiated with the vigorous pursuit of new technologies. Other significant sites they list are Aberdeen Proving Ground, location of the world's first true digital computer (1947); Fort Monmouth, New Jersey, from which the first radio signals into space were sent (1946); and White Sands Proving Ground, New Mexico, where the first atomic device was detonated (1945) and the first missile to penetrate space was launched (1949).

According to Gaither and Peter, Redstone Arsenal was one of the eight most important Army posts from 1950 to 1954, an era they associate with the Korean War and greatly expanding nuclear production. Among the other important installations they identify are Edgewood Arsenal, for chemical and biological weapons development, Dugway Proving Ground, Utah, for chemical and biological agent testing, and Pine Bluff Arsenal, for chemical and biological agent production. Fort Detrick, Maryland, was significant for biological agent development, as was Rocky Mountain Arsenal for chemical agent production. Fort Monmouth was important as the site of the Albert J. Myer Research and Development Center, also known as the Hexagon Laboratory. The Hexagon Laboratory, dedicated in September 1954, conducted R&D in electronics and engineering and made contributions to efforts in the areas of space, missiles, battlefield simulations, and meteorology. Picatinny Arsenal was significant for its work with atomic munitions. Some of the first tactical nuclear weapons were designed there. Gaither and Peter considered Redstone Arsenal significant during this period as the center for Army missile R&D.

Redstone Arsenal is considered by Gaither and Peter to be one of the five most important Army posts from 1955 to 1963, a period they define as the interwar years. From the end of the Korean War to the beginning of the conflict in Vietnam, the U.S. Army was heavily involved in the Space Race and the Nuclear Arms Race. During this period the Army also formulated plans for the "Pentomic Army." The Pentomic Army was an army for the nuclear age. Many believed that the presence of large, strategic nuclear weapons capable of mass destruction would make the Army obsolete. Army planners, however, insisted that such powerful weapons would discourage large-scale nuclear war. Instead, they believed, there would be an increase in small-scale conflicts with the Soviets and their proxies. The Army, therefore, proposed that there should be an emphasis on the

development of tactical nuclear weapons that the Pentomic Army could use in these small-scale conflicts.

The Pentomic Army was highly mobile and consisted of five-part divisions equipped with tactical nuclear weapons and dispersed across a wide front. To equip this force, the Army developed atomic mortars, large cannons, and surface-to-surface missiles, such as the CORPORAL, REDSTONE, and HONEST JOHN, capable of launching nuclear weapons at enemy ground troops. The Army was involved with the development of nuclear weapons at the Nevada Test Site, where these weapons were tested, and the Iowa Army Ammunition Plant and the Pantex Plant, where nuclear weapons were produced. Other important sites identified by Gaither and Peter during this period were Fort Monmouth, where some of the first satellites were developed, and Redstone Arsenal, an important site for missile development.

Although Redstone Arsenal was the center of U.S. Army missile R&D, it is important to note that R&D, testing, and production occurred at other Army posts as well. Radford Arsenal, Virginia, and Longhorn Ordnance Works, Texas, for example, were converted after World War II for the production of missile propellant. Solid propellant was also manufactured and packed at Picatinny Arsenal, New Jersey. Picatinny Arsenal and Rock Island Arsenal, Illinois, were both involved in the development of solid propellants and rocket launchers beginning in 1951. In addition to their plant at Redstone Arsenal, Thiokol had several important facilities throughout the U.S. – the one at Redstone is by no means “exceptionally important.” This firm also developed perchlorate propellant at its facility in Elkton, Maryland.

As far as actually launching rockets, White Sands was the “most significant Army missile test site.”<sup>100</sup> There are several missile test areas at Redstone Arsenal. These areas were generally used to launch only small, tactical missiles. The Guided Missile Test Area was used for the static firing of much larger missiles, such as the REDSTONE and JUPITER. The vast area of White Sands was much more suitable for test launches of these missiles.

Like most Army arsenals during the Cold War, Redstone’s role was limited to R&D, while contractors, under the direction of Redstone Arsenal project managers, conducted large-scale production elsewhere. Arsenals determined how ordnance materiel should be manufactured by making mock-ups and blueprints and operating low-volume pilot lines. Limited missile production, mostly for R&D purposes, occurred at Redstone Arsenal, while large-scale production occurred at various contractor-operated plants throughout the U.S. For example, development of the REDSTONE and JUPITER missiles was completed to the production-engineering phase at Redstone Arsenal, while Chrysler operated a government-owned plant in Detroit for high-volume manufacturing of the missiles. A former textile mill in Burlington, North Carolina, was converted for the production of guidance systems for NIKE AJAX missiles in 1952. This facility, which was operated by Western Electric and designated Tarheel Army Missile Plant in 1963,

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<sup>100</sup> Ibid, p. 96.

assembled many of the Army's missiles.<sup>101</sup> In addition to the above-mentioned sites, the following installations are also associated with the Army missile program: Aberdeen Proving Ground; Harry Diamond Laboratories, Maryland; Pueblo Army Depot, Colorado; Red River Army Ammunition Plant, Texas; and Watervliet Arsenal, New York.<sup>102</sup>

Gaither and Peter identify Redstone Arsenal and Fort Monmouth as the two Army installations important to the Army's mission in space. The U.S. Army Signal Corps laboratories at Fort Monmouth contributed greatly to the early development of satellites. The R&D on guided missiles that occurred at Redstone Arsenal from 1950 to 1960 figured prominently in the Space Race. Beginning in 1958 the Army was assigned a vital role in the space program. Scientists, technicians, and engineers of the Army Ballistic Missile Agency (ABMA) designed, constructed, and tested the large, liquid-fuel rockets that launched the first satellites and lunar probes into space. The REDSTONE, a direct descendant of the German V-2 rocket, served as a foundation. In what amounted to a turn-key operation, ABMA produced the first launch vehicles for space exploration by the Free World.

## 4.2 Site Development

### 4.2.1 Overview

For purposes of this report, the properties examined were those in use by ABMA and its predecessor organizations from 1950 to 1960. During this period of significance the U.S. Army and Redstone Arsenal were important leaders in the Space Race and Nuclear Arms Race. This time period begins with the arrival of the *Operation Paperclip* scientists in Huntsville and ends with the activation of the Marshall Space Flight Center (MSFC), which resulted in the Army's loss of its space mission. It was around this time, also, that the ICBM began replacing the IRBM as the foremost nuclear deterrent.

The Ordnance Rocket Center, established in 1949 and succeeded by Rocket Development Division and, later, Army Rocket and Guided Missile Agency (ARGMA), was responsible for the R&D of free-flight, solid-propellant rockets used as tactical weapons. These missiles were for use in combat against infantry, armor, aircraft, and other missiles. Most of the facilities operated by Ordnance Rocket Center and its successor organizations were located on the southeast side of the installation in the former Redstone Ordnance Plant area. Solid-propellant research facilities operated by Thiokol, Inc. and Rohm and Haas Co. were located there also. Historic maps show Thiokol Corporation, Research and Design Contractors, operating Line 1. Line 2 is shown to be "in standby,"

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<sup>101</sup> Philip Shiman, *Forging the Sword: Defense Production During the Cold War* (n.p.: U.S. Army Construction Engineering Research Laboratories, 1997), p. 64.

<sup>102</sup> Gaither and Peter, p. 88.

while Line 4 is shown in operation by Rohm and Haas Co., Research and Design Contractors.<sup>103</sup>

The U.S. Army Ordnance Guided Missile School was established on the northeast side of Redstone Arsenal in February 1953. Its mission was the training of military and civilian personnel in the design, production, handling, maintenance, and use of rockets and guided missiles. Many post support activities were constructed in this area also.

The Ordnance Guided Missile Center, which was succeeded by the Ordnance Missile Laboratories and ABMA, was located on the west side of Redstone Arsenal in the old Huntsville Arsenal area. This organization consisted of von Braun, his fellow *Operation Paperclip* scientists, and some of the brightest American minds in rocketry. They were assigned the development of large, liquid-fueled ballistic missiles for the Army. The research, design, testing, and limited production of these rockets occurred in this area. The guided missiles they designed were used to launch satellites and nuclear warheads.

#### 4.2.2 Creation of the Guided Missile Center

The old Huntsville Arsenal area became the U.S. Army Ordnance Guided Missile Center in 1950.<sup>104</sup> The new Administration and Design Area was situated on Ward Mountain, also known as "Squirrel Hill," in the old administration area of the Huntsville Arsenal (see Figure 39). Existing World War II buildings were converted into office and laboratory space (see Figure 40). Hannes Lührsen and Hans Grune, *Operation Paperclip* scientists, converted the Army hospital, Building 112, into the Guidance and Control Laboratory for Dr. Theodor Buchhold. The scientists provided free labor and used the entire \$250,000 budget for materials. Von Braun's office was located in nearby Building 111. According to William Pittman, former Redstone staff member, von Braun told them about his plans for launching a satellite with an elongated REDSTONE booster in 1954. "Some of our earliest Army

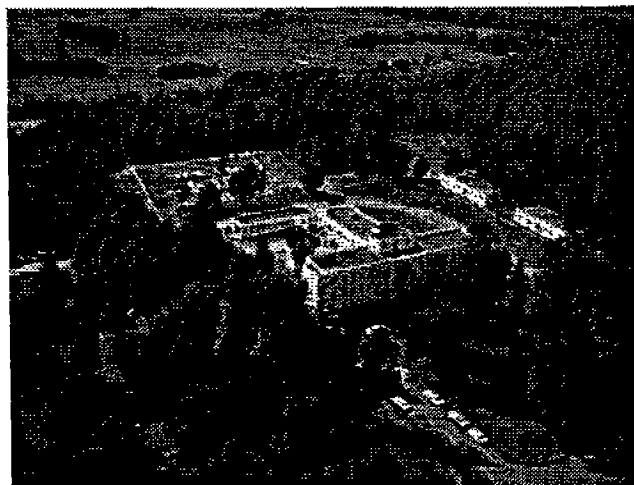


Figure 38. Aerial view of Building 112 and "Squirrel Hill" (1985).

<sup>103</sup> U.S. Department of the Army, Redstone Arsenal, "Reservation Map, Drawing #205, compiled by J.T.M." map, 6 Feb 1950.

<sup>104</sup> Ibid.

missile design and development work was done in Building 112, and you might say the Space Age was born there, too," Pittman said.<sup>105</sup>

The Lab and Test Area was south of the Administration and Design Area in Plants Area No. 1. These buildings, formerly used for the manufacture of chemical warfare agents, were located northeast of the present-day Martin Road/Rideout Road intersection. The Guided Missile Test Area, a new facility, was constructed on Dodd Road, south of Plants Area No. 1.

The Ordnance Guided Missile Center became the Guided Missile Development Division of the Ordnance Missile Laboratories (OML) in 1952. OML had outgrown many of its existing facilities by 1954 (see Figure 41). Building 111 contained OML Administration, the Guidance Design Section, and Purchasing and Contracting. It also contained offices for Chrysler and the Ford Instrument Company. The Guidance and Control Lab was in Building 112. Its three floors contained the Design Office, Research Labs, Gyrostabilizer Labs, Electronic Instrument Assembly Room, Mechanical Assembly Room, Coil Winding Room, Flight Simulation Lab, Electronics Lab, Guidance Computer Labs, and measuring rooms for precision parts and instruments. Building 112A was the Precision Machine Shop for Guidance and Control. The U.S. Army Signal Corps used Building 113. Buildings 114, 116, 117, and 118 contained Guidance and Control shops, labs, and design offices. Building 115 was the steam plant.<sup>106</sup>

The buildings in Plants Area No. 1 were all located north of Martin Road in 1954. These buildings were relatively small and of World War II vintage. U.S. Industrial Chemical Company leased the area on which NASA offices (Building 4200) now sit. Buildings 421 and 422 (now joined as Building 4722) contained Guided Missile Division Headquarters and the Structures and Mechanics Lab. Building 423 (now Building 4723) was the OML Materials Testing Lab. OML storage was in Building 471 (now Building 4471), while Building 481 (now Building 4481) contained the Guided Missile Library, Inspection Laboratory, Launching and Handling Special Equipment Shop, and Guided Missile Assembly Shop. Building 313 (now Building 4313) was the OML Structures Laboratory.<sup>107</sup>

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<sup>105</sup> "Post Hospital Moves but Memories Remain," *Redstone Rocket*, 12 July 1978.

<sup>106</sup> U.S. Department of the Army, Redstone Arsenal, "Redstone Arsenal: Buildings and Structures Utilization Data, Sheet No. 1, Drawing PE-1460, Prepared by Post Engineer," building plans, 1 March 1954.

<sup>107</sup> Ibid, "Redstone Arsenal: Buildings and Structures Utilization Data, Sheet No. 5, Drawing PE-1430, Prepared by Post Engineer," building plans, 1 March 1954.



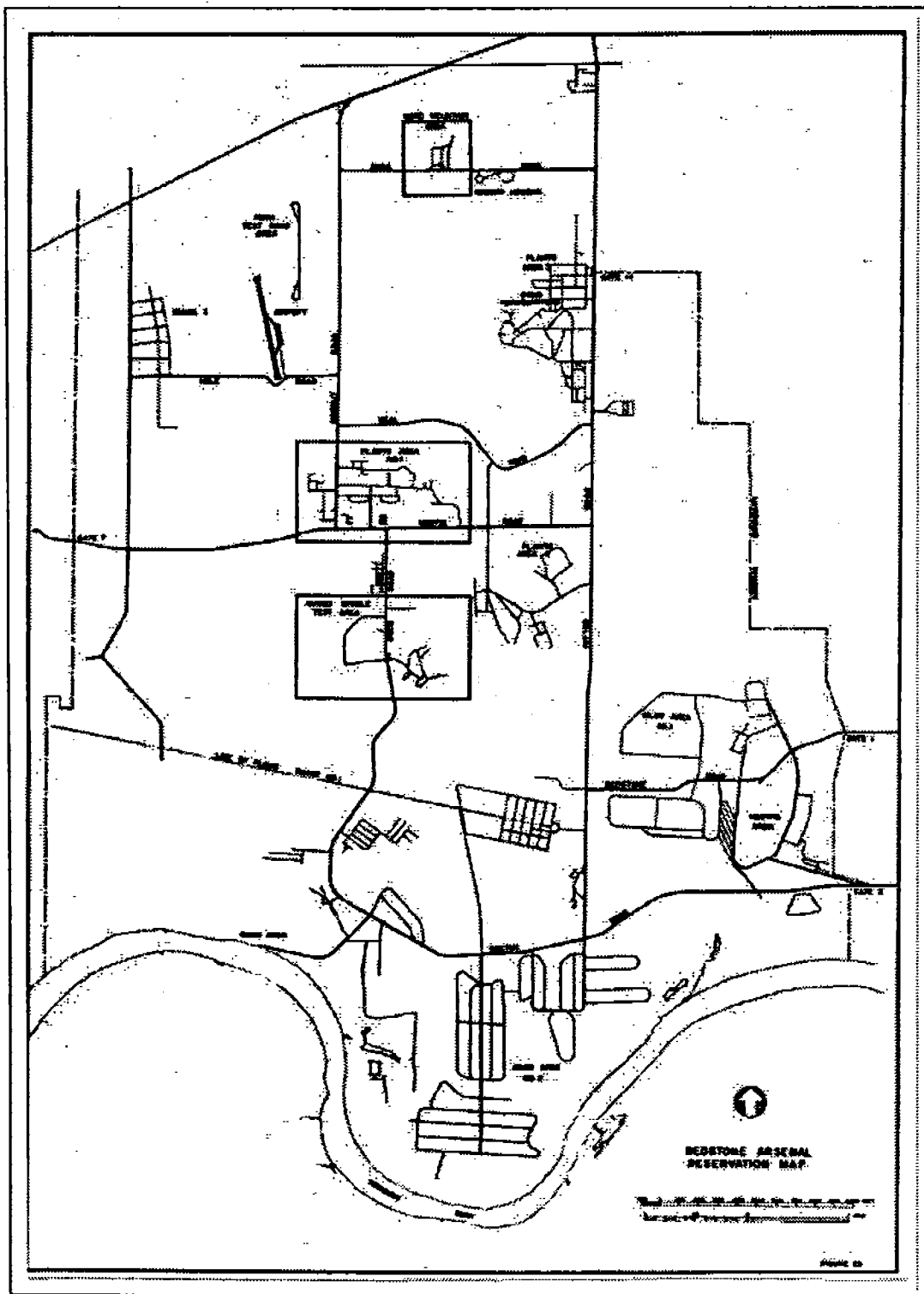


Figure 39. Redstone Arsenal Reservation Map, April 1957.

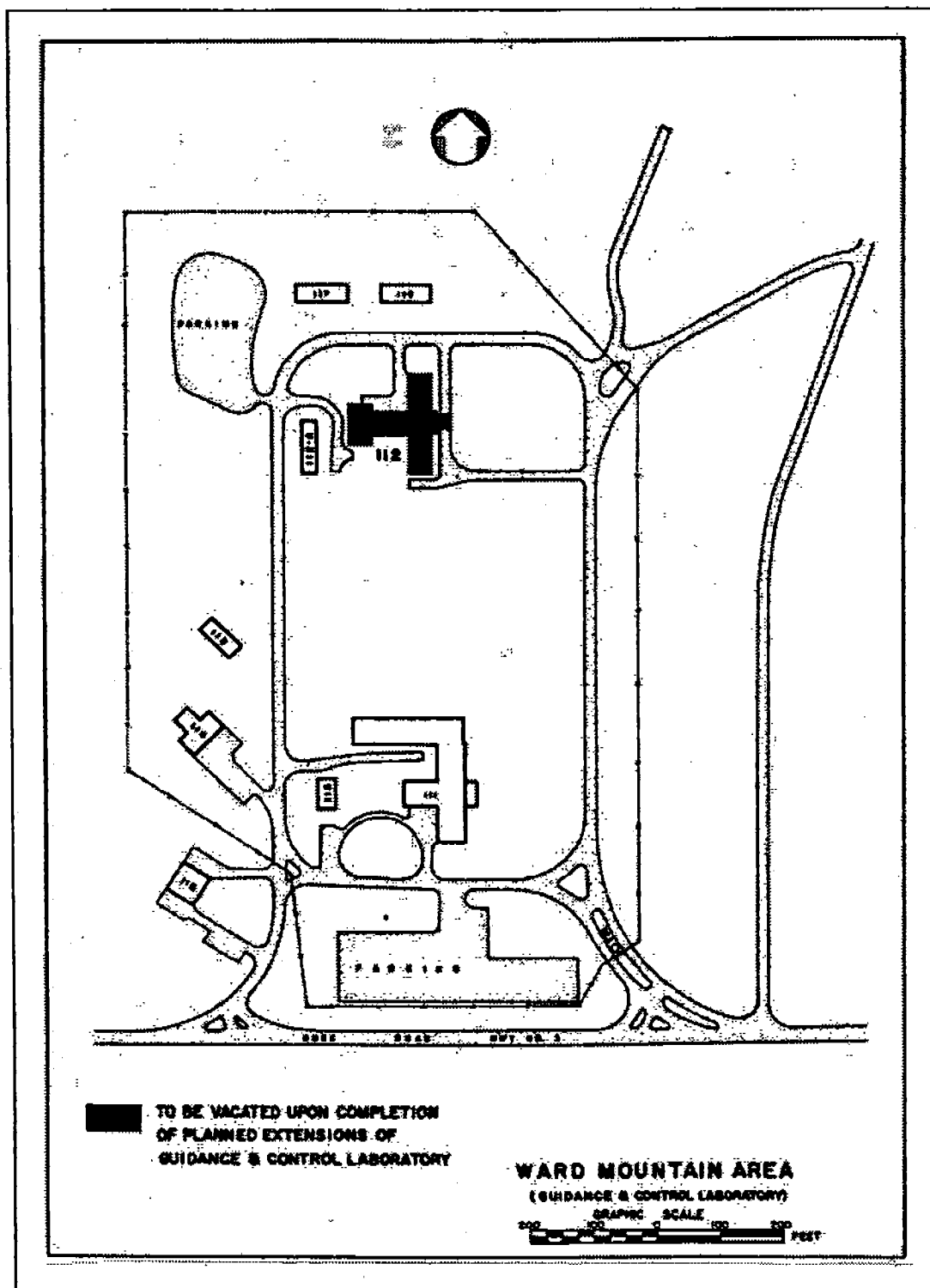


Figure 40. Ward Mountain Area, April 1957.

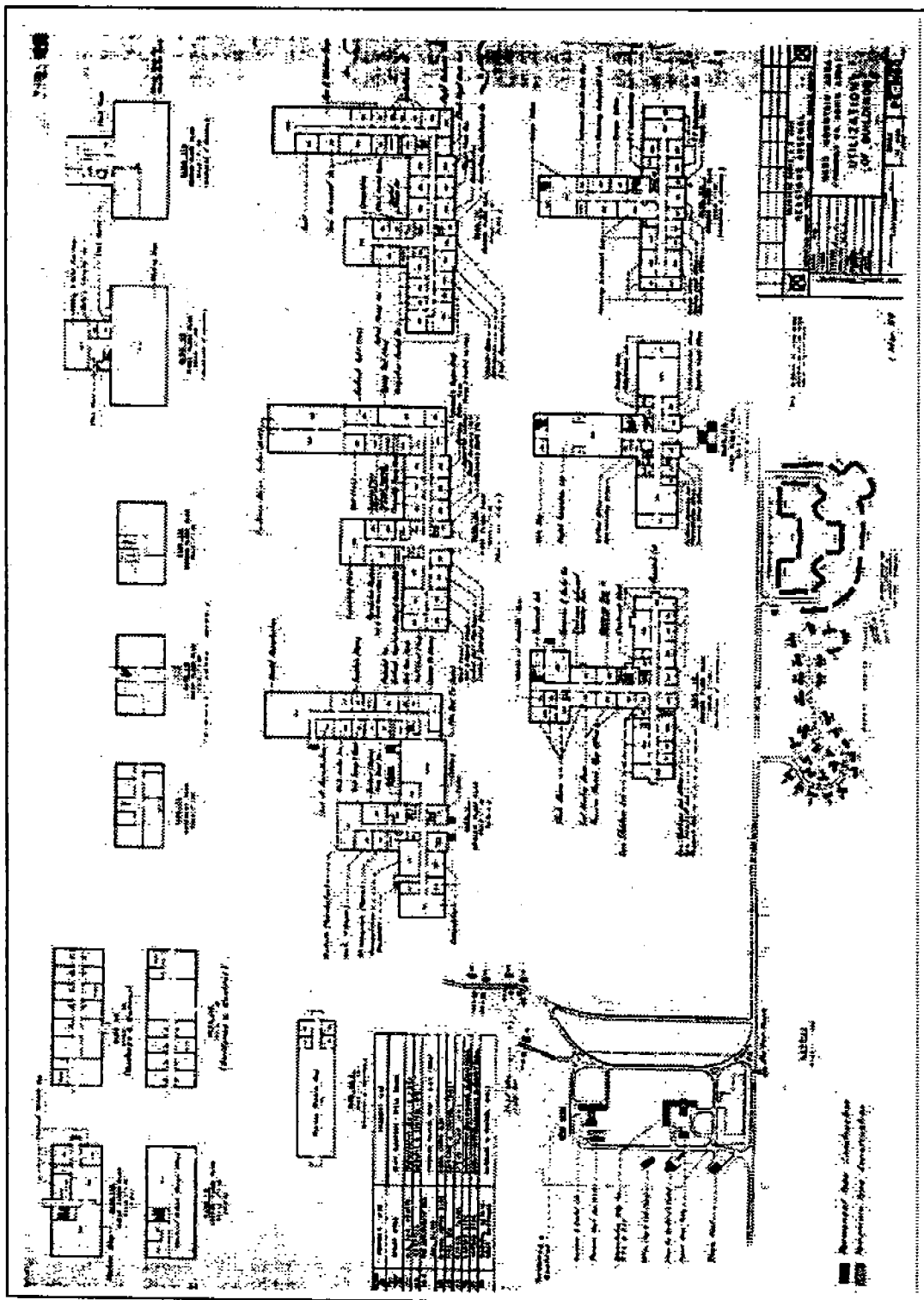


Figure 41. Floor plans of buildings in Ward Mountain Area (*Utilization of Buildings*; March 1, 1954).

#### 4.2.3 The Move to Plants Area No. 1

The successes of the Army's rocket scientists and their REDSTONE guided missile in the early 1950s resulted in more projects, more funding, and, consequently, new buildings. It was decided to relocate personnel from the former administration area of the Huntsville Arsenal to Plants Area No. 1 and consolidate operations. Von Braun and his team would not have to refurbish old World War II buildings this time. Increased appropriations resulted in new, large, modern buildings (see Figure 42).

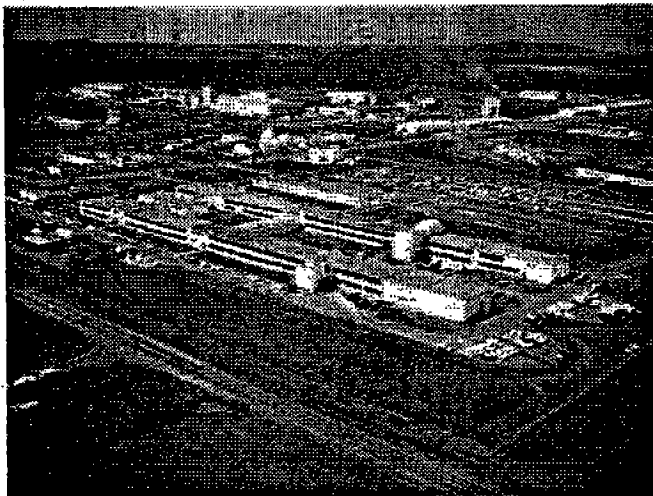


Figure 42. Plants Area No. 1, facing northwest, with Guidance and Control Lab (Building 4487) in foreground (1959).

While many laboratories were in old World War II chemical warehouses, construction began on Buildings 405, 405A, and 405B (Buildings 405 and 405A are now Building 4705 and 405B is Building 4707) in 1953 (see Figure 43). These buildings were used as missile assembly and component hangars and would allow the fabrication of one missile per month. As a result of growing national interest in missile R&D, more construction funds were available in 1954. A new test stand with support buildings was constructed for testing completed missiles under full thrust.

Work also began at that time on Building 4487, the Guidance and Control Lab, and Building 4488, the Research and Development Engineering Building (see Figures 44 and 45). The construction of Building 4488, begun in November 1954, was a major addition to the expanding Plants Area No. 1. Many OML activities, which had been located in numerous small buildings, would be under one roof in this new building. A three-story structure, it had three connecting wings, a reinforced concrete frame, and concrete block walls.<sup>108</sup> According to OML architect Hannes Luehrsen, Building 4488 was designed as the largest building at Redstone Arsenal with maximum flexibility of office and research space. Modern and functional, it was built with movable partitions and underfloor telephone and electrical receptacles.

<sup>108</sup> *Huntsville Times*, 27 March 1955.

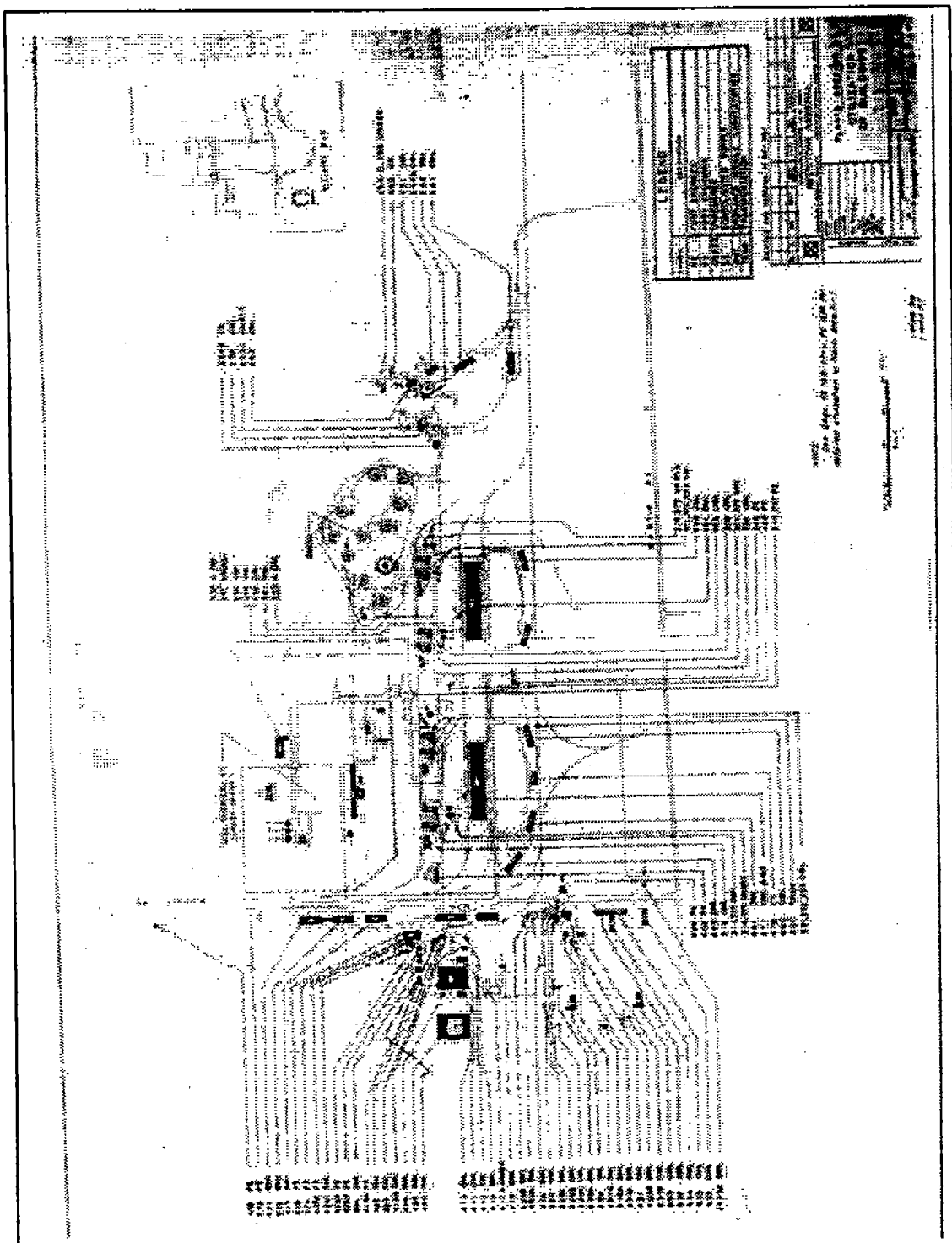


Figure 43. Use of Buildings in Plants Area No. 1  
(Utilization of Buildings; March 1, 1954).

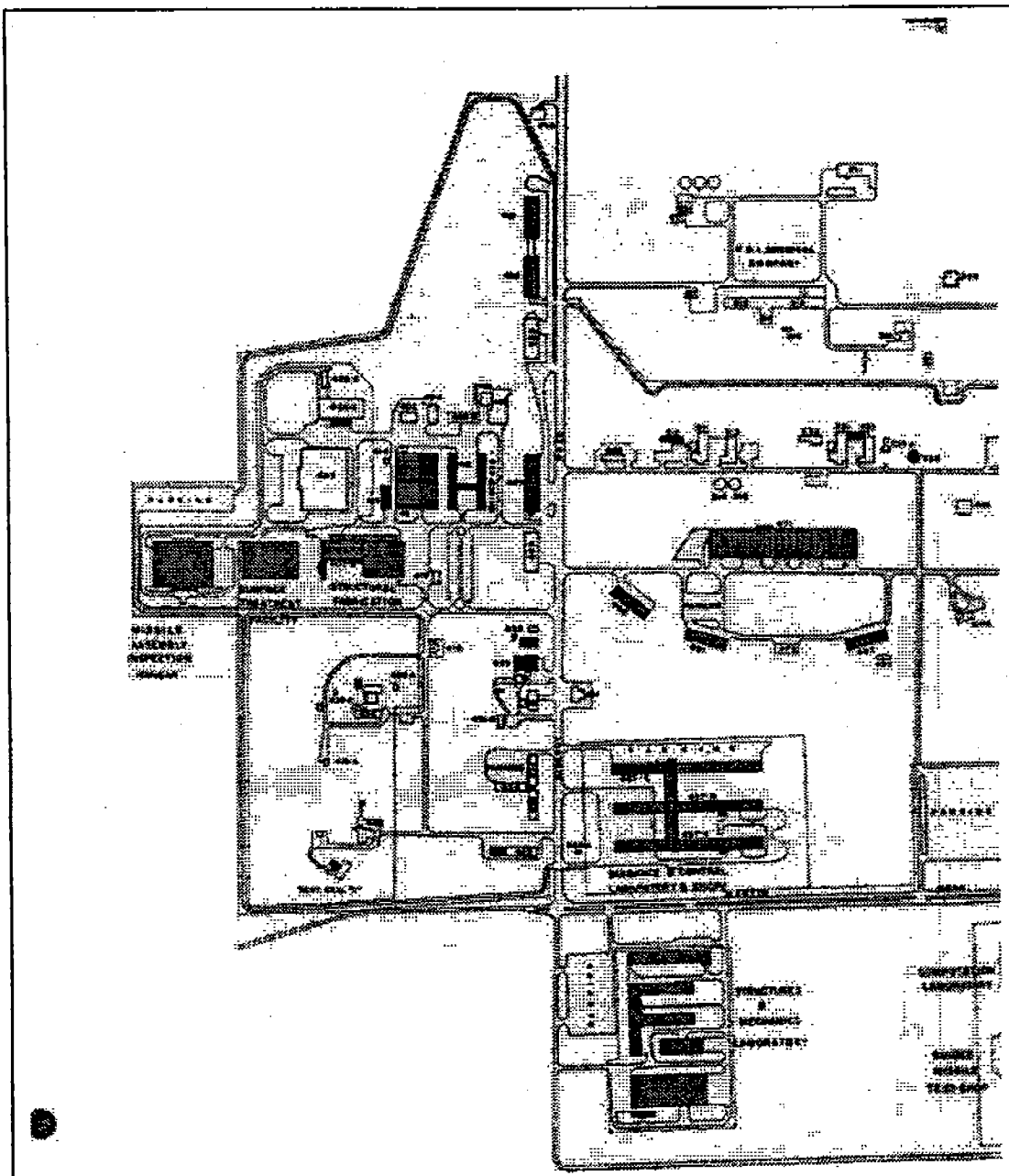


Figure 44. Western half of Plants Area No. 1, April 1957.

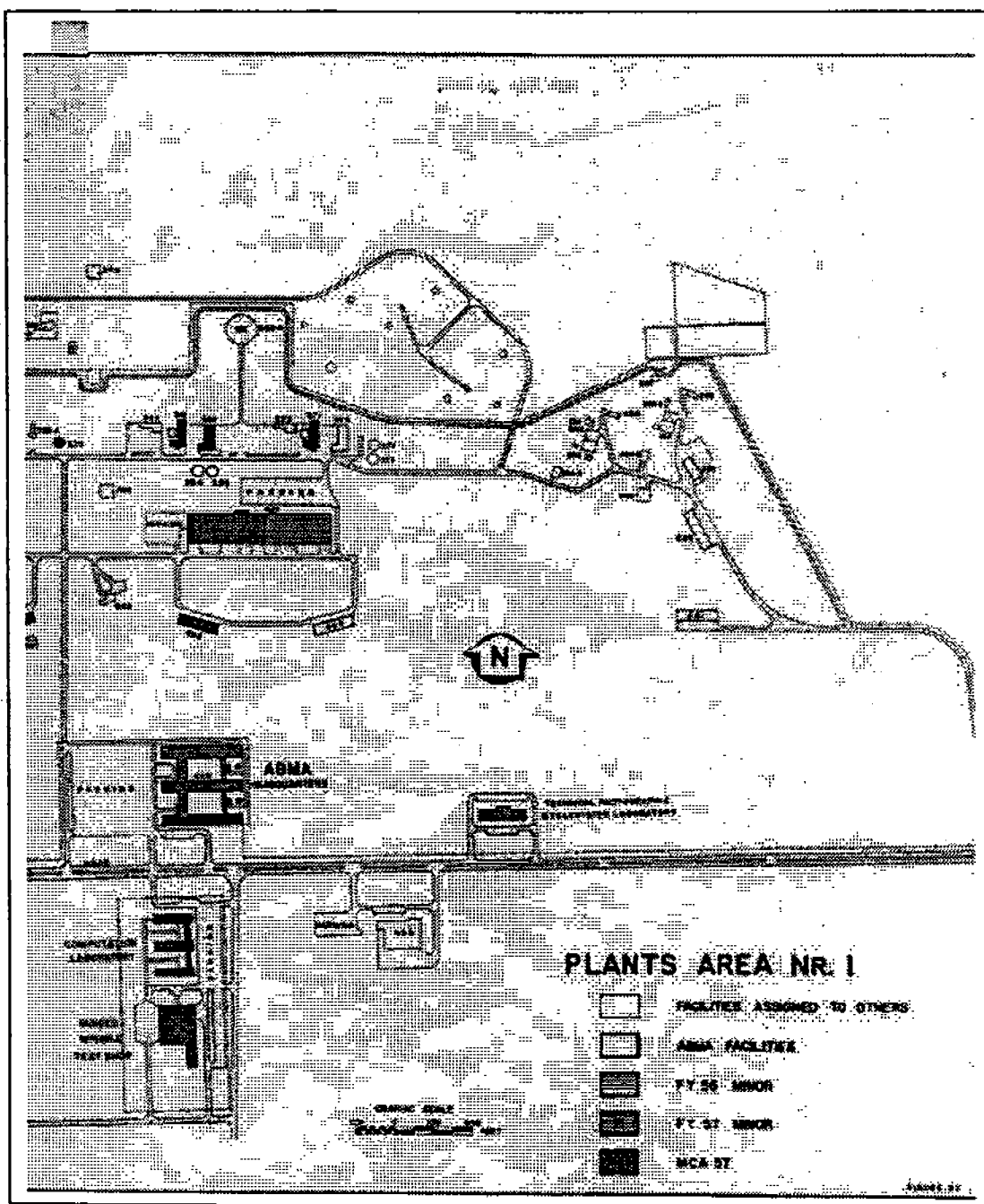


Figure 45. Eastern half of Plants Area No. 1, April 1957.

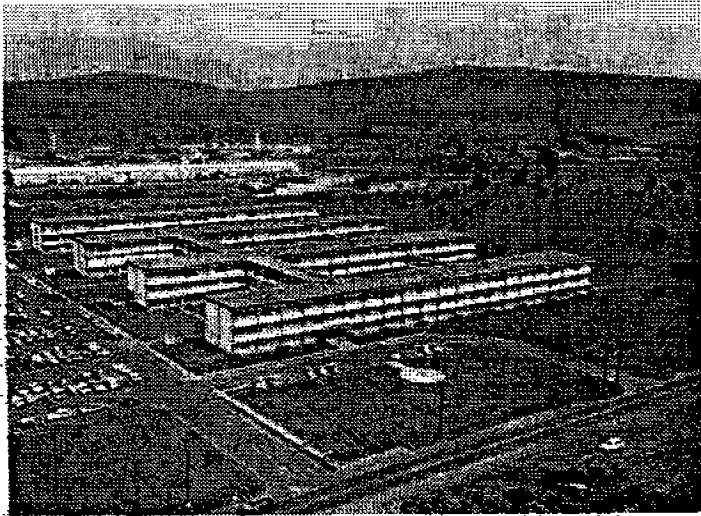


Figure 46. Building 4488, facing northeast (Mustachia, Pictorial Div., AMSC; October 5, 1960).

According to the *Huntsville Times*, the \$2,259,000 building had a parking lot for 600 cars, a lecture room, cafeteria, and technical library.<sup>109</sup> Plans called for 200,000 square feet of floor space, 1842 windows, and office space for 1200 staff members. Built by the J.A. Jones Construction Co. of Atlanta, GA, it was to be used for "guided missile design and engineering work."<sup>110</sup>

Following its completion, Building 4488 became the new ABMA headquarters building. It served as a vital

nerve center for the Army guided missile program throughout the second half of the 1950s. Many of the German rocket scientists had their offices in Building 4488 because, according to Toftoy and Hamill, most of the "key technical personnel and laboratory chiefs of ABMA were members of the original *Paperclip* group."<sup>111</sup> Von Braun had his office in the A-300 suite, while Medaris' was in the A-200 suite.<sup>112</sup>

The Army construction budget for Redstone Arsenal soared over the next several years. Building 4488, completed in late 1955, was part of over \$5 million in construction that occurred at the arsenal 1954-1955.<sup>113</sup> The Missile Assembly Shop (Building 4705) was also completed at this time. The U.S. House of Representatives appropriated over \$2.86 million for Redstone Arsenal in June 1955.<sup>114</sup> Due to the urgency of the JUPITER program, the



Figure 47. Building 4488 interior (1965).

<sup>109</sup> Ibid, 3 October 1954.

<sup>110</sup> *Birmingham News*, 8 October 1954.

<sup>111</sup> Toftoy and Hamill, p. 14.

<sup>112</sup> U.S. Department of the Army, *Official U.S. Army Telephone Directory, Redstone Arsenal* (Redstone Arsenal, Ala.: U.S. Department of the Army, 1957).

<sup>113</sup> *Huntsville Times*, 26 September 1954.

<sup>114</sup> "Arsenal Allotted nearly \$3 Million," *Huntsville Times*, 28 June 1955, p. 1.



Army requested \$25 million for the completion of 11 construction projects in 1956 – these funds would be appropriated over the next five years.<sup>115</sup>

Approximately \$13 million in construction work was completed in 1957 with another \$17 million in progress by January 1958. Construction completed in 1957 for ABMA included the Missile Assembly and Inspection Hanger (Building 4708), the Guided Missile Test Shop (Building 4650), the Surface Treatment Facility (no longer extant), and a large addition to the Structural Fabrication Laboratory (Building 4707). The Computations Laboratory (Building 4663) and the Structures and Mechanics Laboratory (consisting of Buildings 4610, 4612, and 4619) were completed in 1958.<sup>116</sup> Computers were added to Building 4619 for the Blockhouse (Building 4570), which served as the control center for Building 4572, the Propulsion and Structural Test Facility (see Figures 51, 52, and 53).

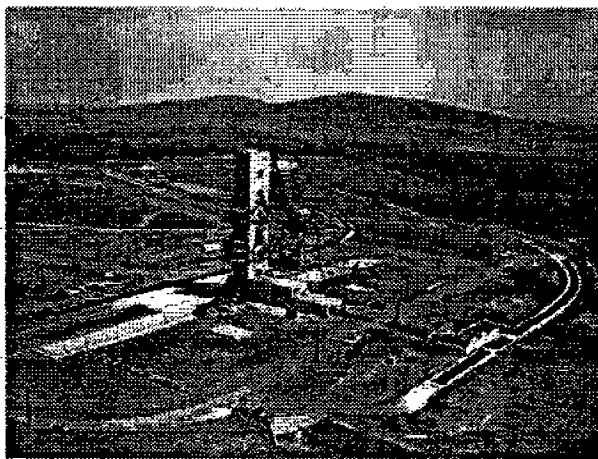


Figure 48. View of Propulsion and Structural Test Facility (Building 4572) in Guided Missile Test Area, facing north.



Figure 49. 1960 aerial view, facing southeast, of Buildings 4505 (top left), 4488 (bottom left), 4500 (top center), 4663 (right center), and 4560 (right).

As the new buildings were completed in Plants Area No. 1, the rocket scientists moved from the buildings in the old Huntsville Arsenal administration area. Missile Instrumentation Development Branch, which was located in Building 112, was the last to vacate the area, moving to Plants Area No. 1 in 1959.

In 1958 Army Ordnance Missile Command (AOMC) was created with Medaris as its first commander. This new organization consisted of the existing ABMA and the newly created ARGMA. NASA was also created in 1958. AOMC and NASA liaison personnel had their offices in Building 4488, while ARGMA headquarters were

in Building 7101. Most ARGMA facilities were located in the old Redstone Ordnance Plant area and were formerly operated by the Ordnance Rocket Center.

<sup>115</sup> Baker et al, *History of the JUPITER Missile System*.

<sup>116</sup> "\$13 Million in Building Completed at Redstone," *Birmingham Post-Herald*, 2 January 1958.

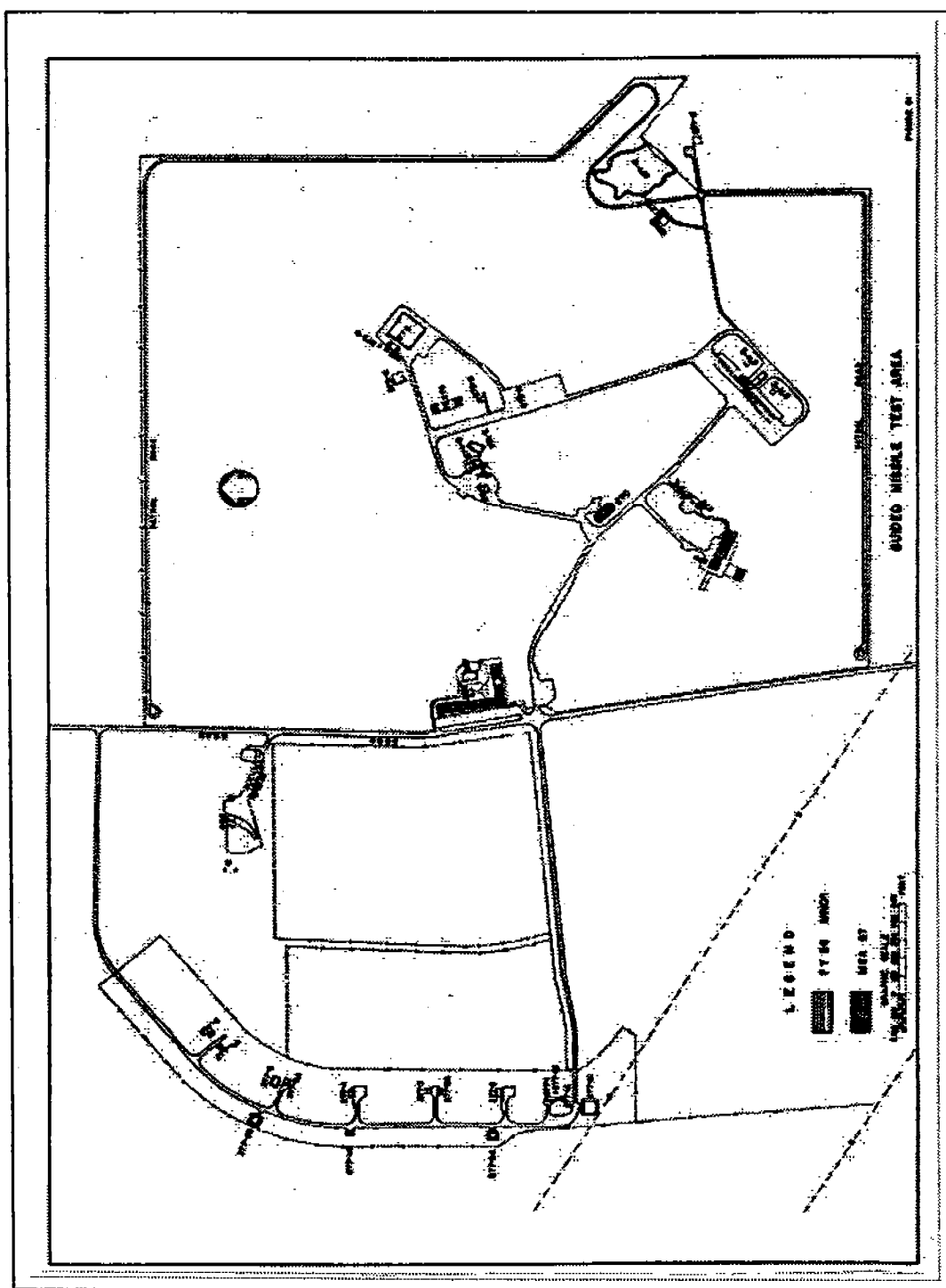


Figure 50. Guided Missile Test Area, April 1957.

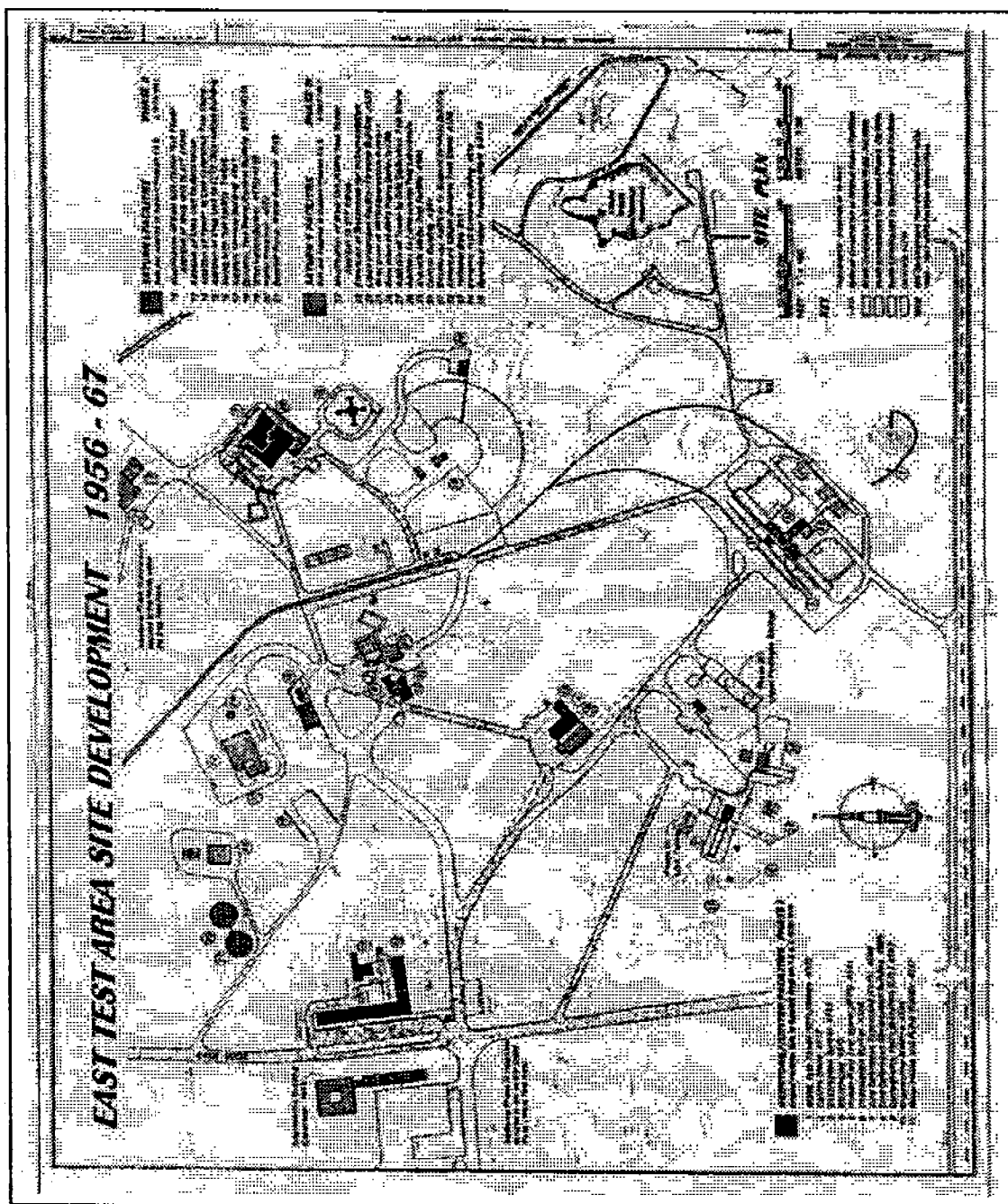


Figure 51. Historic American Buildings Survey (HABS) documentation of Guided Missile Test Area, 1996 (*East Test Area Site Development 1956-1967*).

[illegible]

Figure 52. HABS documentation of Guided Missile Test Area (*East Test Area Site Operations c. 1960*).

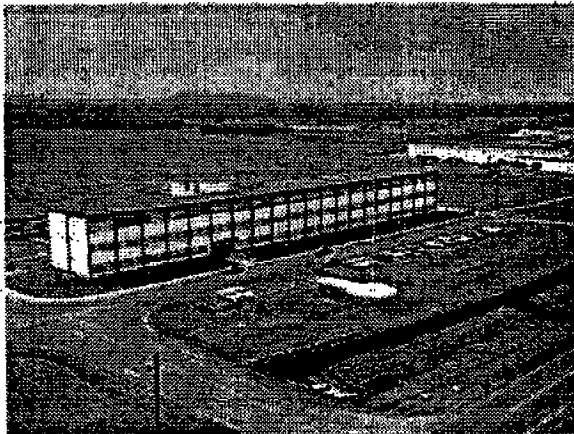


Figure 53. Building 4505, facing southwest.

In November 1958, Medaris, whose office had been in Building 4488 for almost two years, moved with his staff to Building 4505, the newly constructed AOMC headquarters building. He had his offices here until 1960. Building 4488, however, continued to be a very important center of activity. The JUPITER Project Office, U.S. Air Force JUPITER Liaison Office, and Strategic Air Command Liaison Office were located in Building 4488. It also contained the offices for the directors of the ARPA-NASA, REDSTONE, JUPITER, and PERSHING projects. Building 4488 continued to be the

headquarters for ABMA. It contained ABMA Headquarters and the offices of the leading administrators and scientists of ABMA. ABMA's Field Support Division, Industrial Division, and Development Operations Division had their main offices in Building 4488. Research facilities were here for ABMA's Aeroballistics Laboratory, Computation Laboratory, Missile Firing Laboratory, and Research Projects Laboratory. It also had the ABMA technical documents library and the ABMA departmental offices for Civilian Personnel, Operating Services, Facilities Planning, Financial Management, and Control.<sup>117</sup>

Eisenhower's October 1959 decision to transfer most of ABMA's personnel, facilities, and missions to NASA did not immediately impact Building 4488 or the activities occurring there. Von Braun, head of Development Operations Division of ABMA, and his staff continued to work in Building 4488 following the activation of NASA's MSFC in July 1960. It was one of the few ABMA buildings not transferred to

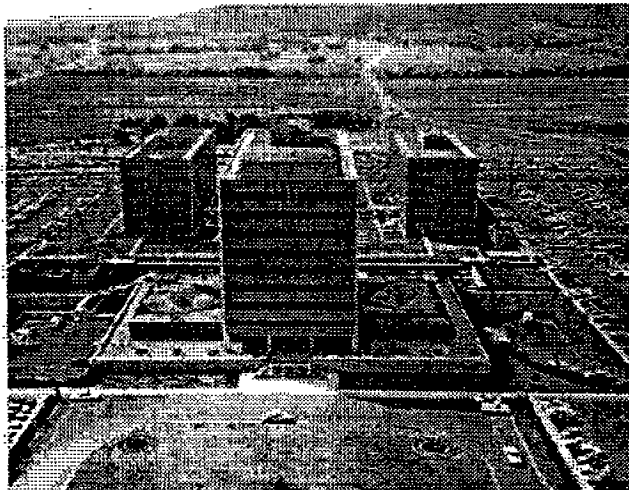


Figure 54. MSFC Headquarters (Building 4200), ca. 1963.

<sup>117</sup> U.S. Department of the Army, *Official U.S. Army Telephone Directory, Redstone Arsenal* (Redstone Arsenal, Ala.: U.S. Department of the Army, 1959).

MSFC. Building 4488 served as joint headquarters for ABMA and MSFC, and von Braun, who was MSFC's first director, continued to occupy his suite of offices. Building 4488 was an important center of NASA activity at Redstone Arsenal until completion of the MSFC Headquarters (Building 4200) in 1963.

With the loss of ABMA's space missions and most of its staff and facilities, it was necessary for AOMC to reorganize ABMA and ARGMA. ABMA continued to provide support to NASA and ARPA, but this was phased out in the early 1960s. ABMA continued to work on the REDSTONE, JUPITER, and PERSHING missiles and was assigned all preprogrammed surface-to-surface missiles. It also received additional missile projects from ARGMA to even the workload between the two agencies. ARGMA, in the meantime, retained control of NIKE ZEUS, NIKE AJAX, NIKE

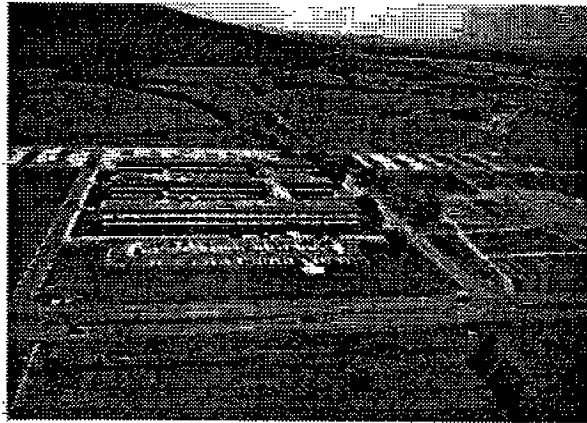


Figure 55. Aerial view of Building 5250, facing north (ca. 1960).

HERCULES, FABMDS, HAWK, MAULER, REDEYE, LACROSSE, SHILLELAGH, SS-10/11, and target missiles. In October 1960 ARGMA occupied its new headquarters, Building 5250.

ABMA and ARGMA ceased to exist when they were consolidated into AOMC in December 1961. As part of the overall reorganization of the Army and the creation of U.S. Army Materiel Command (AMC) on August 1, 1962, AOMC was discontinued and U.S. Army Missile Command (MICOM) was activated in its place. While the MSFC expanded to the south of Plants Area No. 1 during the 1960s and 1970s, the Army built new R&D facilities to the east. Building 5250 became headquarters for MICOM in 1962 and continued as such until the Sparkman Center was completed in 1994.

## **4.3 Identification of Historic Properties**

### **4.3.1 Preliminary Fieldwork**

The National Park Service and staff at Redstone Arsenal were consulted in order to identify existing or pending NRHP nominations for resources at the installation. No pending NRHP nominations were identified, but four properties are listed in the NRHP as National Historic Landmarks (NHLs). These landmarks, which are located within MSFC boundaries, are the Neutral Buoyancy Space Simulator (located in Building 4705), the Redstone Rocket Test Stand (Building 4665), the Propulsion and Structural Test Facility (Building 4572), and the SATURN V Dynamic Test Stand (Building 4550). A fifth

NHL, a SATURN V Launch Vehicle, is located at the U.S. Space and Rocket Center on the north side of Redstone Arsenal.

Historical research and military guidelines were used to establish a Cold War historic context for Redstone Arsenal in order to identify which resources should be considered exceptionally important, and thereby NRHP eligible. As a result of these efforts, it was determined that buildings at Redstone Arsenal associated with the Nuclear Arms Race and Space Race should be identified and assessed for potential NRHP eligibility under Criteria Consideration G. Books, newspaper articles, post telephone directories, consultations with staff members at the U.S. Army Aviation and Missile Command history office, building plans, and historic maps were among the sources used to identify such buildings. Forms for the U.S. Army properties surveyed may be found in Appendix III, while assessments of these buildings are in Appendix IV. Appendix IV also includes the MSFC buildings that were examined as part of this project.

Assessments focused on buildings constructed prior to 1961 and used for guided missile R&D during the installation's period of significance. U.S. Army buildings appearing to be NRHP eligible were found in the Ward Mountain Area, which was used as the Huntsville Arsenal Administration Area during World War II. This area is where the Guided Missile Center was established in 1950 and where ABMA had offices and laboratories. Exceptionally important Army buildings were also identified in Plants Area No. 1. This industrial area was used during World War II for the manufacture of chemical warfare agent. ABMA and its predecessor organizations had offices, shops, and laboratories in this area. The Guided Missile Test Area was also included in the architectural reconnaissance. This is where ABMA and its predecessor organizations had blockhouses, static test stands, propellant storage areas, and other buildings and structures for the field testing of rocket engines and launch vehicles.

Contrary to previous surveys, this report does not consider resources associated with ARGMA and its predecessor organizations to be NRHP eligible within the Cold War historic context of the arsenal. This includes production lines and test areas located in the old Redstone Ordnance Plant area. ARGMA was concerned with the R&D of smaller, tactical rockets and the solid propellant that powered them. In contrast, ABMA concentrated on the R&D of large, liquid-fueled guided missiles.

The facilities in Appendix IV that are now part of the MSFC are controlled and managed by NASA. Therefore, they were not evaluated for potential NRHP eligibility. The field reconnaissance was undertaken with the cooperation of NASA officials, but no potential NRHP historic district containing NASA properties was delineated. The only buildings evaluated for NRHP eligibility by this study are those under the management of the U.S. Army. Among these resources is the proposed Guided Missile Center Historic District, which is located on Ward Mountain. This historic district consists of Buildings 109, 110, 111, 112, 113, 114, 115, 116, and 118. Of these, Buildings 109, 113, and 115 are not considered to be contributing resources.

Individual Army buildings in Plants Area No. 1 considered NRHP eligible are Buildings 4381, 4484, 4488, 4489, 4505, and 4722. Because NASA controls most of Plants Area No. 1 and the entirety of the Guided Missile Test Area, the Army is not authorized to make determinations of eligibility for potential historic districts in these areas. NASA is responsible for completing the environmental compliance procedures for buildings it manages.

Building 7132, site of the June 1957 court-martial of Colonel John C. Nickerson, Jr., was also identified as an exceptionally important Cold War property during the architectural reconnaissance. It was recently demolished under a memorandum of agreement between the Redstone Arsenal Support Activity, the Alabama State Historic Preservation Office, and the Advisory Council on Historic Preservation. As a result of Section 106 compliance procedures, Building 7132 was determined NRHP eligible by the Army in 1996 within Redstone Arsenal's World War II historic context.



Figure 56. A 1998 view of Building 7132, facing north.

#### 4.3.2 Criteria for Evaluation

In order to determine NRHP eligibility, the Criteria for Evaluation were applied to the proposed Guided Missile Center Historic District, individual resources in Plants Area No. 1, and Building 7132. The district contains resources that possess "significant concentration, linkage, or continuity" and are "united historically or aesthetically by plan or physical development."<sup>118</sup> The proposed district should be considered eligible for the NRHP under criteria A, B, and C on the national level. It has a 1950-1956 period of significance. As required by the NPS, this group of buildings has a character and coherence that differentiates it from adjacent areas as a historic environment.

The buildings and structures considered NRHP eligible within the installation's Cold War context have gained significance within the past fifty years, so they are NRHP eligible under Criteria Consideration G. In accordance with Army guidelines, resources that contribute marginally to the Guided Missile Center Historic District were considered non-contributing:

A marginal contribution is defined as a property that, should it be destroyed without any record of its existence, an irrevocable data gap would exist that would impair the ability of a technical audience to

<sup>118</sup> U.S. Department of the Interior, National Park Service, p. 5.



understand the mission of the district or its association. The intent is that unlike traditional historic districts, where marginal properties can be considered eligible and contributing, districts comprised of exceptional properties are exclusive and on a higher level . . . <sup>119</sup>

Only those buildings and structures important to understanding the unique aspects of the installation's Cold War missions were considered to be eligible resources. Redstone's Cold War properties are eligible under Criterion A, because they are "associated with historic events or activities that have made a significant contribution to the broad patterns of history." Activities that occurred at Redstone Arsenal are directly associated with the following Cold War activities:

- **The Militarization of Space/The Space Race** – Beginning in 1950, Redstone Arsenal became the center for U.S. Army missile R&D. The launch of the first American satellite, EXPLORER I, into orbit in 1958 and the first flight of an American astronaut, Commander Alan B. Shepard, Jr., in 1961 were direct results of design efforts at Redstone Arsenal. ABMA was given a special space mission by ARPA and was assigned the task of launching of several satellites and a lunar probe in the late 1950s. Army scientists in Huntsville, Alabama, laid the foundation for America's space program.
- **The Nuclear Arms Race** – The staff at Redstone Arsenal were responsible for the development of short- and intermediate-range ballistic missiles for the delivery of nuclear weapons. Before the first U.S. Air Force ICBMs became operational in 1958, the missiles designed at Redstone were a vital part of the United States' nuclear force: they served in the first line of defense in the event of a nuclear war and were a potent threat to the Soviet Union.
- **R&D of the REDSTONE missile** – The REDSTONE, which was based upon the design of the German V-2, was the United States' first operational short-range ballistic missile. Research, design, development, testing, and limited production of REDSTONES occurred at Redstone Arsenal. In July 1958 a REDSTONE was the first American missile to successfully launch and detonate a nuclear device. Known as "Old Reliable," the REDSTONE rocket was a bulwark of America's Cold War nuclear arsenal from 1958 to 1964.
- **R&D of the JUPITER missile** – With its successful launch of May 31, 1957, the JUPITER became America's first intermediate-range ballistic missile (IRBM). Research, design, development, testing, and limited production of JUPITERs occurred at Redstone Arsenal. JUNO I, which launched EXPLORER I into orbit on January 31, 1958, was a modified JUPITER C booster. Designed as a successor to REDSTONE, JUPITER

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<sup>119</sup> U.S. Department of the Army, Director of Environmental Programs, p. 46.

missile units were first deployed in 1960. The threat of JUPITER missiles in Turkey helped precipitate the Cold War drama known as the Cuban Missile Crisis in October 1962. As a result of tense negotiations, JUPITERs were withdrawn from Turkey and Italy in exchange for the removal of Soviet IRBMs in Cuba.

The Cold War properties at Redstone Arsenal are also eligible under Criterion B, because they are "associated with the lives of significant persons in our past." The following exceptionally important Cold War persons are historically associated with this Army post:

- **Dr. Wernher von Braun (1912-1977)** – Recognized as one of the foremost rocket scientists in the world, von Braun refused offers from the Soviet Union following World War II and came to America to design missiles for the U.S. Army. His genius laid the foundation for America's nuclear missile force and space program. A great visionary who dreamed of space travel, von Braun designed a launch vehicle in 1954 that, if pursued, could have beat the Soviet SPUTNIK into space by a year. He had offices in Building 111 during the Guided Missile Center Historic District's period of significance. He later had an office suite in Building 4488. Von Braun worked throughout Plants Area No. 1 and the Guided Missile Test Area. Von Braun was selected as the first director of NASA's Marshall Space Flight Center in 1960. One of mankind's greatest feats, putting astronauts on the moon, had its origins with von Braun and his staff at Redstone Arsenal in the 1950s.
- **The German Rocket Scientists of *Operation Paperclip*** – As a result of *Operation Paperclip*, which may be defined as the first skirmish of the Cold War, over 125 of the top German rocket scientists and engineers were hired away from the Soviets to develop the U.S. Army missile program. Creators of the infamous V-2 rocket, these men were considered to be 20 years ahead of the rest of the world in rocket science. They came to Huntsville in 1950 and formed the core of the Army's Guided Missile Center. Many of the *Operation Paperclip* scientists held top positions in ABMA and went on to work for NASA in 1960. These men had offices and laboratories throughout Plants Area No. 1 and the Guided Missile Test Area.
- **Army Ballistic Missile Agency (ABMA)** – The rocket scientists and engineers of this agency, which was established at Redstone Arsenal in February 1956 for the development of the JUPITER missile, were among the best in the United States. Due to the urgency of the nuclear arms race, the commander of ABMA received extraordinary powers in the area of purchasing and acquisition. ABMA was not required to follow normal contracting procedures. ABMA designed, developed, produced, and launched America's first IRBM and launched the first earth satellite,

EXPLORER I, into orbit. ABMA personnel and facilities comprised NASA's Marshall Space Flight Center when it was created at Redstone Arsenal in 1960.

- **Major General John B. Medaris (1902-1990)** – First commander of ABMA, Medaris had exceptional powers and vast amounts of funding at his disposal for purchase and acquisition. This level of support in the area of procurement reflected the urgency of the Nuclear Arms Race and the Space Race with the Soviets. An engineering and scientific expert on guided missile development, he was a nationally recognized authority and a significant leader in the evolving U.S. space program. He became the first commander of the new U.S. Army Ordnance Missile Command at Redstone Arsenal in 1958.

The Cold War properties managed by the Army at Redstone Arsenal are not NRHP eligible under Criterion C. These buildings do not “embody the distinctive characteristics of a type, period, or method of construction,” or “represent the work of a master,” or “possess high artistic values” that are exceptionally important. The exceptional importance of these resources is derived entirely through Criteria A and B.



Figure 57. Medaris in his office in Building 4488 (ca. 1957).



Figure 58. Nickerson, with his family, outside the courtroom (Building 7132), June 1957.

According to Real Property records at Redstone Arsenal, Building 7132 was constructed in 1945 as a semi-permanent building. Prior to 1957, when it was used in the court-martial of Nickerson, it was converted to its present use as a courtroom. This report identifies it as exceptionally important because it was the site of the trial. It was significant on the national level under Criteria A and B. Because it was an intact example of World War II Army architecture, it was considered eligible under Criterion C within the post's World War II context.

The Nickerson Trial was a highly publicized national event that occurred at

Redstone Arsenal during the Cold War. Issues relating to national security, the Nuclear Arms Race, interservice rivalry in the area of missile R&D, and the conscience of an individual were put on trial in Building 7132. Referred to as the "Billy Mitchell of the Cold War," Nickerson was a principled soldier who acted, as he believed, in the best interests of the U.S. during a critical time of the Cold War. His exceptionally important court-martial brought to focus the significant work undertaken by the U.S. Army at Redstone Arsenal in the eyes of the American people. Prior to demolition, Building 7132 had a high level of historical integrity.

As mentioned earlier in this report, resources must exhibit good integrity to be eligible for the NRHP. Integrity is divided into seven separate qualities: location, design, setting, materials, workmanship, feeling, and association. Although many of the buildings at Redstone Arsenal have been heavily altered and new buildings have been constructed on the post, Redstone Arsenal's Cold War properties continue to maintain integrity of location, setting, feeling, and association. Design, materials, and workmanship have been diminished in many instances, but not enough for the properties to lose their historic identity or character.

#### **4.3.3 Proposed Boundaries**

The boundary of the proposed Guided Missile Center Historic District encompasses the old Huntsville Arsenal administration area on Ward Mountain. Constructed during World War II and renovated by von Braun and his staff in 1950, it is an easily identified cluster of buildings located north of Goss Road. Boundaries extend from Building 116 on the north to Goss Road on the south side. Buildings are on Cooper Drive and Hankins Drive, which are on the east and west sides of the area, respectively.

Individual Army Cold War properties are located in Plants Area No. 1, in the center of the post. Located south of the Ward Mountain Area, Plants Area No. 1 contains many buildings constructed by ABMA and its predecessor organizations through 1960. Most of the buildings in this area are now part of the MSFC. The pre-1960 buildings are oriented around the intersection of Rideout Road, a north-south road, and Martin Road, which runs east-west. These buildings extend, roughly, from Pioneer Road on the north to Fowler Road on the south. This area extends from the Toftoy Thruway on the east to include buildings on Gemini Avenue on the west side. Although Plants Area No. 1 was not evaluated for NRHP eligibility as a historic district (due primarily to the presence of MSFC buildings) individual Army buildings were identified as NRHP eligible, as previously noted, within this area. The boundaries of these Cold War properties should contain the immediate setting of each building.

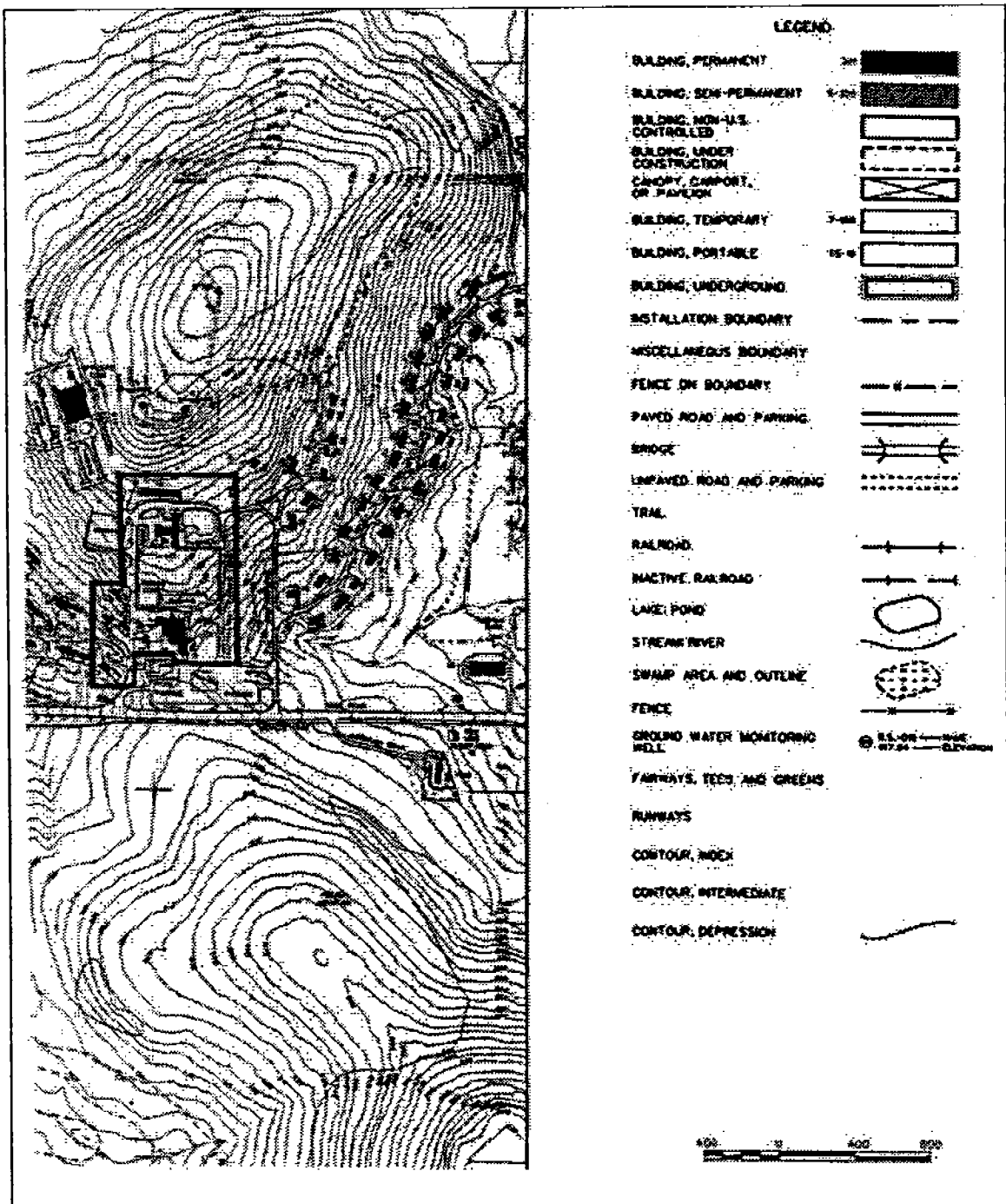


Figure 59. Proposed boundary of Guided Missile Center Historic District.

#### **4.3.4 Recommendations for Future Historic Resource Management**

Redstone Arsenal Support Activity (RASA) should continue the process of identifying and evaluating historic resources at Redstone Arsenal. Further research and documentation should be completed on the exceptionally important Army properties identified by this report. It is recommended that RASA and the environmental staff at the MSFC coordinate on the identification of an ABMA Historic District, which might include both Plants Area No. 1 and the Guided Missile Test Area. Another option would be to coordinate with NASA on a multiple resource nomination. These resources could qualify as National Historic Landmarks because of the significant events that occurred at Redstone Arsenal during the Cold War.

The important role of the U.S. Army in early space exploration is not generally acknowledged by mainstream history. The Army has a small display at the U.S. Space and Rocket Center in Huntsville. Guides from the center do not inform visitors of the Army's pioneering efforts in space as the tour buses pass by Army buildings adjacent to the MSFC. NASA is popularly viewed – incorrectly – as the agency that started the U.S. space program. Nomination of these potential historic districts and dissemination of historical information to the public would help reaffirm the Army's exceptionally important role as a historic leader in the Space Race.

This report assesses only Army resources that might be considered exceptionally important within the Cold War historic context of Redstone Arsenal. These resources are associated with the Guided Missile Center or its successor organizations, which are OML, ABMA, and AOMC. Therefore, further efforts should be made to assess the buildings and structures constructed during the Cold War by the Army at Redstone Arsenal.

Appendix V is a chart that identifies Army buildings that will reach 50 years of age within the next five years. It includes buildings that may be NRHP eligible as part of a potential historic district for the Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949. Building 7650 and Building 7770 have high levels of integrity and are good examples of modern architecture. Both may be NRHP eligible on an individual basis. The chart also includes barracks and classroom buildings that may be eligible as part of a potential historic district for the Ordnance Guided Missile School, which was established in February 1953.

Buildings constructed as a result of the creation of the MSFC and AMC will begin qualifying age-wise for the NRHP in 2010. All of these buildings should be reassessed for eligibility before they reach the 50-year age requirement of the NRHP. By doing so, RASA will insure that it fulfills its obligations to protect the Army's heritage by properly managing the historic resources of Redstone Arsenal.

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## **APPENDIX I.**

### **REASSESSMENT OF COLD WAR RESOURCES PREVIOUSLY SURVEYED**

## APPENDIX I.

### REASSESSMENT OF COLD WAR RESOURCES PREVIOUSLY SURVEYED

This chart is a reassessment of the Cold War resources originally assessed in *Architectural and Historic Inventory of Buildings and Structures Dating to the Cold War-Era (1946-1989) at the Redstone Arsenal, Alabama* by Ruth D. Nichols of TRC Mariah Associates, Inc. It is important to note that this reassessment takes into account the Cold War historic context provided in *Rocket Science*.

BLDG #	Cold War Use	Built	Reassessed	Comments
111	Guided Missile R&D	1941	Eligible	Determined not eligible for NRHP by Nichols Report. It is, however, associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. See Appendix IV.
112	Guided Missile R&D	1942	Eligible	Determined not eligible for NRHP by Nichols Report. It is, however, associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. See Appendix IV.
3200	Enlisted Barracks	1955	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3201	Enlisted Barracks	1955	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3202	Enlisted Barracks	1955	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3203	Enlisted Barracks	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3204	Enlisted Barracks	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3205	Enlisted Barracks	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3206	Enlisted Barracks	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3207	Enlisted Barracks	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3208	Enlisted Barracks	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3209	Enlisted Barracks	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3210	Enlisted Barracks	1955	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3211	Enlisted Barracks	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
3212	Enlisted Barracks	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.



[illegible]

4500	Administration	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4505	Administration	1960	Eligible	Determined not eligible for NRHP by Nichols Report. It is, however, associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. See Appendix IV.
4722	Guided Missile R&D	1941	Eligible	Determined not eligible for NRHP by Nichols Report. It is, however, associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
5201	Administration	1962	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
5250	Administration	1960	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
5400	NIKE R&D	1964; 1994; 1995	Not Eligible	McMorrow Labs was considered NRHP eligible by Nichols Report. It is not, however, associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
5435	Administration & Laboratories	1966	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
5451	Photo Lab	1942	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
5452	Unknown	1943	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
5475	R&D	1962	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
5671	Mustard Gas Production	1942	Not Eligible	Determined not eligible for NRHP by Nichols Report. Later determined eligible as part of H Line in World War II Huntsville Arsenal historic context. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
5673	Mustard Gas Production	1942	Not Eligible	Determined not eligible for NRHP by Nichols Report. Later determined eligible as part of H Line in World War II Huntsville Arsenal historic context. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
5678	Administration	1942, 1943	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
5687	Administration	1942, 1943	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
6260	R&D; PERSHING Missile Support	1985	Not Eligible	Considered NRHP eligible by Nichols Report. It is not, however, associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
6305	Blockhouse	1970	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
6307	Firing Station	1975	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
6307A	Rocket Auditorium/Propulsion Lab; Headquarters and library	1953	Not Eligible	Determined not eligible for NRHP by Nichols Report. Maintains some interesting architectural features despite exterior renovation. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7120				
7155	Propellant Facility	1988	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7156	Administration; R&D	1952	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

7309	Pilot Production Process	1988	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7319	Pack-out of Assembled Rocket Motors	1989	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7339	Propellant Mixing and Casting	1960	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7344	Large Motor Assembly	1960	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7345	X-ray	1960	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7346	Small Motor Case Preparation	1987	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7347	Small Motor Loading	1987	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7352	Propellant Mixing and Casting	1989	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7353	Propellant Mixing and Casting	1989	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7354	Propellant Mixing	1989	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7356	Propellant Mixing	1987	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7358	Small Motor Finishing	1989	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7359	Casting Can & Bowl Clean-out	1967	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7360	Propellant Mixing and Casting	1959, 1961, 1989	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7364	Rocket Motor R&D	1945	Not Eligible	Considered NRHP eligible by Nichols Report as part of Redstone Arsenal Rocket Engine (RARE) Facility, North Plant (Former North Thiolol Area). Site of testing, development, and limited production of rocket motors. Many were prototypes for HERMES, FALCON, PERSHING, and SPARTAN missile systems. The area is not, however, associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7365	Motor Pack-out	1959	Not Eligible	Considered NRHP eligible by Nichols Report as part of RARE historic district. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7368	Rocket Motor R&D	1942	Not Eligible	Considered NRHP eligible by Nichols Report as part of RARE historic district. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7369	Rocket Motor R&D	1942	Not Eligible	Considered NRHP eligible by Nichols Report as part of RARE historic district. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7370	Teflon Preparation	1958	Not Eligible	Considered NRHP eligible by Nichols Report as part of RARE historic district. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Demolished 1999.



7373	Rocket Motor R&D	1942	Not Eligible	Considered NRHP eligible by Nichols Report as part of RARE historic district. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7375	Static Test	1942	Not Eligible	Considered NRHP eligible by Nichols Report as part of RARE historic district. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Demolished 1999.
7376	Static Test	1958	Not Eligible	Considered NRHP eligible by Nichols Report as part of RARE historic district. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Demolished 1999.
7380	Propellant Waste Disposal	1959	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7382	Propellant Mixing and Casting	1959	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Demolished 1999.
7386	Propellant Mixing	1965	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Demolished 1999.
7387	Propellant Mixing	1965	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7521	Propellant Mixing and Casting	1985	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7522	Propellant Mixing and Casting	1985	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7567	Unknown	1940	Not Evaluated	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within Redstone Arsenal Cold War Historic Context. Considered eligible within World War II historic context.
7587	Test Facility	1962	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7593	Propellant Mixing and Casting	1959	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7594	Propellant Mixing and Casting	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7595	Propellant Facility	1955	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7601	Unknown	1942	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7603	Unknown	1942	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7607	Walkway	1942	Not Eligible	Located between 7603 and 7608. Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7608	Unknown	1942	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Demolished 1999.
7609	Unknown	1945	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7610	Unknown	1942	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

7611	Administration Office	1960	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7620	Rocket Propellant Test Facility	1958	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Cleared for demolition SFPO.
7621	Chemical Laboratory	1940s	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7622	Chemical Storage	1940s	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7623	Chemical Storage	1940s	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7624	Chemical Storage	1940s	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7625	Rocket Motor Production; PATRIOT Missile Assembly	1957	Not Eligible	Considered eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7628	Photo Lab & Lockers	1957	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7629	Motor Conditioning & Testing	1957	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7630	Motor Pool & Paint Facility	1959	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7632	Chemistry Laboratory	1955	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7636	Laboratory & Offices	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7640	Storage	1940s	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7643	Core Assembly	1940s	Not Eligible	Considered NRHP eligible by Nichols Report as part of RARE historic district. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7644	Maintenance Shop	1940s	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Demolished 1999.
7645	Environmental Conditions Testing	1940s	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7649	Administration	1984	Not Eligible	Considered NRHP eligible by Nichols Report as part of RARE historic district. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7650	Administration	1953	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7653	Rocket Motor R&D	1941	Not Eligible	Considered NRHP eligible by Nichols Report as part of RARE historic district. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Demolished 1999.
7660	Tool Cleaning Facility	1958	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7661	Safety Area	1966	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

7686	Unknown	1943	Not Eligible	Considered NRHP eligible by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7688	Grinding & Drying Propellants	1978	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7689	Grinding & Drying Propellants	1978	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7690	Grinding & Drying Propellants	1978	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7691	Oxidizer Processing	1978	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7694	Grinding & Drying Propellants	1988	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7695	Grinding & Drying Propellants	1989	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7722	Unknown	1941	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7724	Unknown	1942	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7727	Unknown	1941	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7728	Unknown	1941	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Demolished 1999.
7740	Case Preparation & Processing	1960	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7742	Degreasing	1987	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7770	Administration & Labs; Explosives/Fuels R&D	1951	Not Eligible	Considered NRHP eligible by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7807	Missile Distance Indicator	1974	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7808	Propulsion System Building	1956	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7820	Blockhouse	1953	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7821	Firing Bay	1953	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7822	Firing Bay	1953	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7831	Support	1977	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7843	PERSHING Test Stand	Ca. 1960	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

7848	Vibration Testing	1959	Not Eligible	Test Bay 7. Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7851	Vibration Testing	1959	Not Eligible	Test Bay 7. Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7856	Blockhouse	1953	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7857	Vibration Testing	1969	Not Eligible	Test Bay 5. Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7858	Static Test Facility	1953	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
7861	Static Test Facility	1953	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
8514	Hazardous Lightning Testing	Ca. 1980	Not Eligible	Considered NRHP eligible by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
8876	Blockhouse	1960	Not Eligible	Considered NRHP eligible by Nichols Report. Located in Test Area #5. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
8877	Static Test Stand	1960	Not Eligible	Considered NRHP eligible by Nichols Report. Located in Test Area #5. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
8879	Static Test Stand	1960	Not Eligible	Considered NRHP eligible by Nichols Report. Located in Test Area #5. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
8882	Support for Static Test Stand	1962	Not Eligible	Considered NRHP eligible by Nichols Report. Located in Test Area #5. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
8883	Static Test Stand	1962	Not Eligible	Considered NRHP eligible by Nichols Report. Located in Test Area #5. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
8973	Administration	1945	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
8975	Quiet Facility	1945	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
8978	Administration	1945	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Demolished 1999.
No Number Assigned	Bowen Camera Pads	Unknown	Not Eligible	Located in Test Area #1. Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
No Number Assigned	Electromagnetic Pulse Simulator	Ca. 1975	Not Eligible	Considered NRHP eligible by Nichols Report. Used for PERSHING and PATRIOT missile testing. Not associated with the people, programs, or events considered exceptionally important in the Redstone Arsenal Cold War Historic Context.
No Number Assigned	Near Strike Lightning Facility	Ca. 1976	Not Eligible	Considered NRHP eligible by Nichols Report. Used for PERSHING and PATRIOT missile testing. Not associated with the people, programs, or events considered exceptionally important in the Redstone Arsenal Cold War Historic Context.
No Number Assigned	Missile Sled with Dual Track	Ca. 1955	Not Eligible	Located in Test Area 1. Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
No Number Assigned	Test Area 7	1960-1980	Not Eligible	Determined not eligible for NRHP by Nichols Report. Not associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

**APPENDIX II.**

**CRITERIA CONSIDERATION G**

## APPENDIX II.

### CRITERIA CONSIDERATION G: PROPERTIES THAT HAVE ACHIEVED SIGNIFICANCE WITHIN THE PAST FIFTY YEARS

[From the U.S. Department of the Interior, National Park Service's *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation.*]

A property achieving significance within the past fifty years is eligible if it is of *exceptional importance*. (For more information on Criteria Consideration G, refer to National Register Bulletin 22: *Guidelines for Evaluating and Nominating Properties that Have Achieved Significance Within the Past Fifty Years.*)

#### Examples of Properties that MUST Meet Criteria Consideration G: Properties that Have Achieved Significance Within the Past Fifty Years

- ☐ A property that is less than fifty years old.
- ☐ A property that continues to achieve significance into a period less than fifty years before the nomination.
- ☐ A property that has non-contiguous Periods of Significance, one of which is less than fifty years before the nomination.
- ☐ A property that is more than fifty years old and had no significance until a period less than fifty years before the nomination.

#### Examples of Properties that DO NOT Need to Meet Criteria Consideration G: Properties that Have Achieved Significance Within the Past Fifty Years

- ☐ A resource whose construction began over fifty years ago, but the completion overlaps the fifty year period by a few years or less.
- ☐ A resource that is significant for its plan or design, which is more than fifty years old, but the actual completion of the project overlaps the fifty year period by a few years.
- ☐ A historic district in which a few properties are newer than fifty years old, but the majority of properties and the most important Period of Significance are greater than fifty years old.

#### *Understanding Criteria Consideration G: Properties that Have Achieved Significance Within the Past Fifty Years*

The National Register Criteria for Evaluation exclude properties that achieved significance within the past fifty years unless they are of exceptional importance. Fifty years is a general estimate of the time needed to develop historical perspective and to evaluate significance. This consideration guards against the listing of properties of passing contemporary interest and ensures that the National Register is a list of truly historic places.

#### Applying Criteria Consideration G: Properties That Have Achieved Significance Within The Last Fifty Years Eligibility for Exceptional Importance

The phrase "exceptional importance" may be applied to the extraordinary importance of an event or to an entire category of resources so fragile that survivors of any age are unusual. Properties listed that had attained significance in less than fifty years include: the launch pad at Cape Canaveral from which men first traveled to the moon, the home of nationally prominent playwright Eugene O'Neill, and the Chrysler Building (New York) significant as the epitome of the "Style Moderne" architecture.

Properties less than fifty years old that qualify as exceptional because the entire category of resources is fragile include a recent example of a traditional sailing canoe in the Trust Territory of the Pacific Islands, where because of rapid deterioration of materials, no working Micronesian canoes exist that are more than twenty years old. Properties that by their nature can last more than fifty years cannot be considered exceptionally important because of the fragility of the class of resources.

The phrase "exceptional importance" does not require that the property be of national significance. It is a measure of a property's importance within the appropriate historic context, whether the scale of that context is local, State, or national.

#### **Eligible**

- ☐ The General Laundry Building in New Orleans, one of the few remaining Art Deco Style buildings in that city, was listed in the National Register when it was forty years old because of its exceptional importance as an example of that architectural style.
- ☐

#### **Historical Perspective**

A property that has achieved significance within the past fifty years can be evaluated only when sufficient historical perspective exists to determine that the property is exceptionally important. The necessary perspective can be provided by scholarly research and evaluation, and must consider both the historic context and the specific property's role in that context.

In many communities, properties such as apartment buildings built in the 1950s cannot be evaluated because there is no scholarly research available to provide an overview of the nature, role, and impact of that building type within the context of historical and architectural developments of the 1950s.

#### **National Park Service Rustic Architecture**

Properties such as structures built in a rustic style by the National Park Service during the 1930s and 1940s can now be evaluated because a broad study, National Park Service Rustic Architecture (1977), provides the context for evaluating properties of this type and style. Specific examples were listed in the National Register prior to reaching fifty years of age when documentation concerning the individual properties established their significance within the historical and architectural context of the type and style.

#### **Comparison with Related Properties**

In justifying exceptional importance, it is necessary to identify other properties within the geographical area that reflect the same significance or historic associations and to determine which properties best represent the historic context in question. Several properties in the area could become eligible with the passage of time, but few will qualify now as exceptionally important.

#### **Eligibility for Information Potential**

A property that has achieved significance within the past fifty years can qualify under Criterion D only if it can be demonstrated that the information is of exceptional importance within the appropriate context and that the property contains data superior to or different from those obtainable from other sources, including other culturally related sites. An archeological site less than fifty years old may be eligible if the former inhabitants are so poorly documented that information about their lifeways is best obtained from examination of the material remains.

#### **Eligible**

- ☐ Data such as the rate of adoption of modern technological innovations by rural tenant farmers in the 1950s may not be obtainable through interviews with living persons but could be gained by examination of homesites.

#### **Not Eligible**

- ☐ A recent archeological site such as the remains of a Navajo sheep corral used in the 1950s would not be considered exceptionally significant for its information potential on animal husbandry if better information on the same topic is available through ethnographic studies or living informants.

#### **Historic Districts**

Properties which have achieved significance within the past fifty years can be eligible for the National Register if they are an integral part of a district which qualifies for National Register listing. This is demonstrated by documenting that the property dates from within the district's defined Period of Significance and that it is associated with one or more of the district's defined Areas of Significance.

Properties less than fifty years old may be an integral part of a district when there is sufficient perspective to consider the properties as historic. This is accomplished by demonstrating that: 1) the district's Period of Significance is justified as a discrete period with a defined beginning and end, 2) the character of the district's historic resources is clearly defined and assessed, 3) specific resources in the district are demonstrated to date from

that discrete era, and 4) the majority of district properties are over fifty years old. In these instances, it is not necessary to prove exceptional importance of either the district itself or the less-than-fifty-year-old properties. Exceptional importance still must be demonstrated for district where the majority of properties or the major Period of Significance is less than fifty years old, and for less-than-fifty-year-old properties which are nominated individually.

**Properties More Than Fifty Years in Age, Less Than Fifty Years in Significance**

Properties that are more than fifty years old, but whose significant associations or qualities are less than fifty years old, must be treated under the fifty year consideration.

***Eligible***

- ☐ A building constructed early in the twentieth century (and having no architectural importance), but that was associated with an important person during the 1950s, must be evaluated under Criteria Consideration G because the Period of Significance is within the past fifty years. Such a property would qualify if the person was of exceptional importance.

**Requirement to Meet the Criteria, Regardless of Age**

Properties that are less than fifty years old and are not exceptionally important will not automatically qualify for the National Register once they are fifty years old. In order to be listed in the National Register, all properties, regardless of age, must be demonstrated to meet the Criteria for Evaluation.



### **APPENDIX III.**

## **SURVEY FORMS FOR U.S. ARMY BUILDINGS ASSESSED AT REDSTONE ARSENAL**

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

109

**5. CONDITION**

Excellent

**2. LOCATION**

Ward Mountain

**6. INTEGRITY**

Excellent

**3. CONSTRUCTION DATE**

1962

**7. NRHP ASSESSMENT**

Not eligible

**4. USE (Original/Current)**

Unknown/Unknown

**8. PHOTOGRAPHY**

Roll # 2

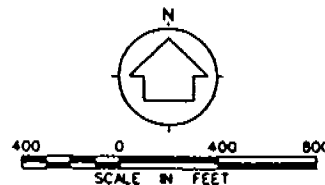
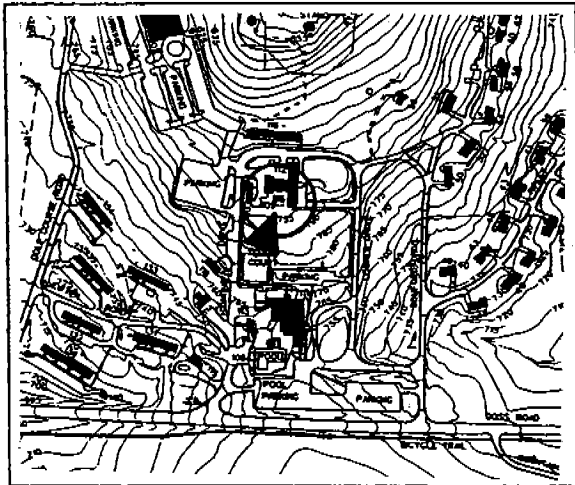
Photo# 1, 2

**9. DESCRIPTION**

Small, one-story utility building with rectangular plan and flat roof. Masonry veneer exterior and concrete slab foundation. Three windows on north elevation. Metal louvered doors. Concrete water table with splash course.

**10. SIGNIFICANCE**

Not an exceptionally important resource within Cold War historic context for proposed Guided Missile Center Historic District.

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

110

**5. CONDITION**

Good

**2. LOCATION**

Ward Mountain

**6. INTEGRITY**

Fair

**3. CONSTRUCTION DATE**

1943

**7. NRHP ASSESSMENT**

Eligible

**4. USE (Original/Current)**

Medical clinic / Supply Services Admin

**8. PHOTOGRAPHY**

Roll # 1

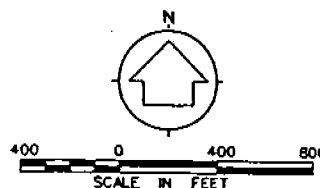
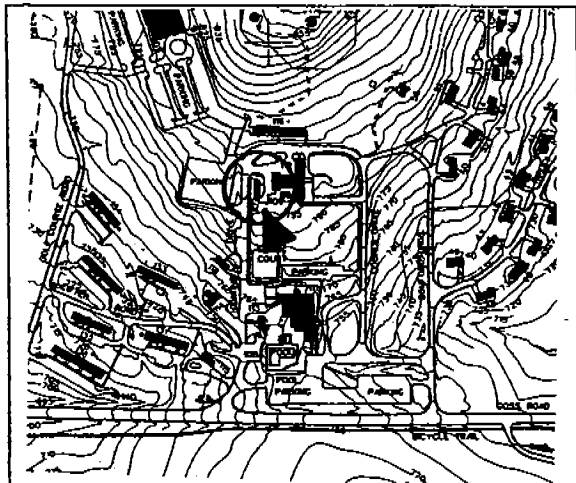
Photo# 31, 32

**9. DESCRIPTION**

Small, one-story building with rectangular plan and flat roof. Corrugated metal replacement siding and concrete slab foundation. One-over-one double-hung sash replacement windows and metal replacement doors.

**10. SIGNIFICANCE**

Originally a pre-employment medical clinic for Huntsville Arsenal. Guidance and Control (G&C) precision machine shop ca. 1950-1957. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

111

**5. CONDITION**

Excellent

**2. LOCATION**

Ward Mountain

**6. INTEGRITY**

Fair

**3. CONSTRUCTION DATE**

1942

**7. NRHP ASSESSMENT**

Eligible

**4. USE (Original/Current)**

Huntsville Arsenal HQ / Administration

**8. PHOTOGRAPHY**

Roll # 2

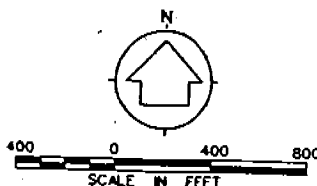
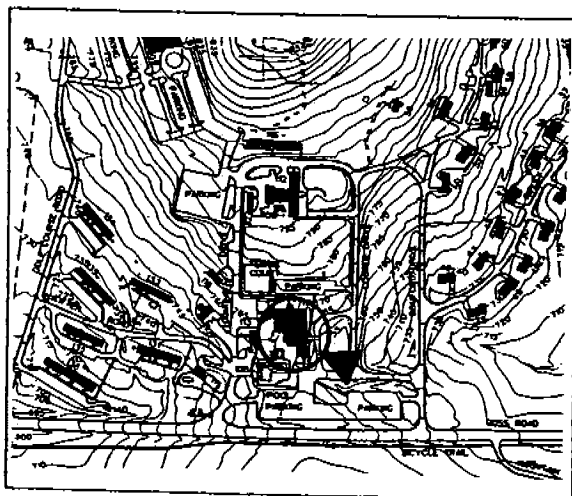
Photo# 11, 12

**9. DESCRIPTION**

Concrete slab foundation; structural clay tile walls covered with corrugated metal siding [added 1984]; single-hung sash and single-pane windows; metal-frame windows and doors; flat roof; two stories; 57,154 square feet.

**10. SIGNIFICANCE**

HQ for Ordnance Guided Missile Center beginning in 1949. Von Braun's office here 1950-1956. Served as Officers' Open Mess in late 1950s. Converted to office space in 1985. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Design attributed to Whitman, Requardt, & Smith; Baltimore, Maryland.

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

112

**5. CONDITION**

Excellent

**2. LOCATION**

Ward Mountain

**6. INTEGRITY**

Fair

**3. CONSTRUCTION DATE**

1942

**7. NRHP ASSESSMENT**

Eligible

**4. USE (Original/Current)**

Hospital / RASA HQ

**8. PHOTOGRAPHY**

Roll # 2

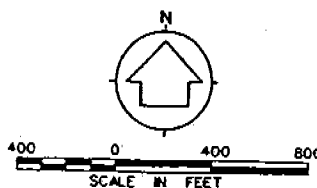
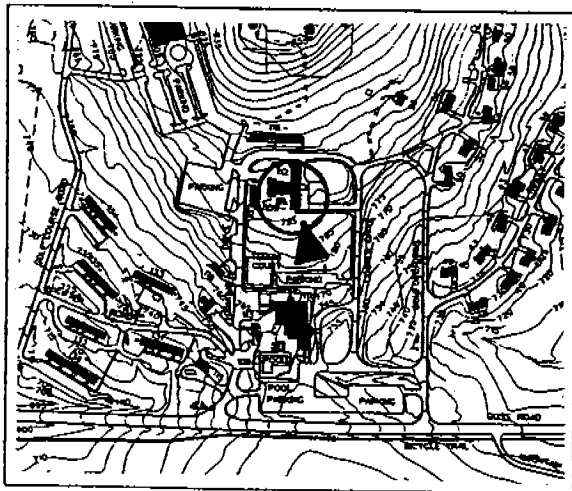
Photo# 3, 4

**9. DESCRIPTION**

Concrete slab foundation; structural clay tile walls covered with corrugated metal siding [added 1984]; single-hung sash windows; metal-frame windows and doors; flat roof; three stories; T plan; ca. 40,000 square feet.

**10. SIGNIFICANCE**

G&C Laboratory 1950-1957. Used by ABMA Development Operations Division, Missile Instrumentation Development Branch as late as 1959. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Design attributed to Whitman, Requardt, & Smith; Baltimore, Maryland.

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

113

**5. CONDITION**

Good

**2. LOCATION**

Ward Mountain

**6. INTEGRITY**

Fair

**3. CONSTRUCTION DATE**

1942

**7. NRHP ASSESSMENT**

Not eligible

**4. USE (Original/Current)**

Signal Corps Office Building / Morale  
Support Activities

**8. PHOTOGRAPHY**

Roll # 2

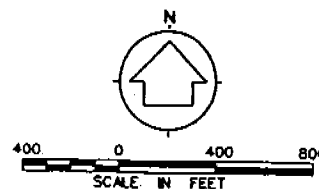
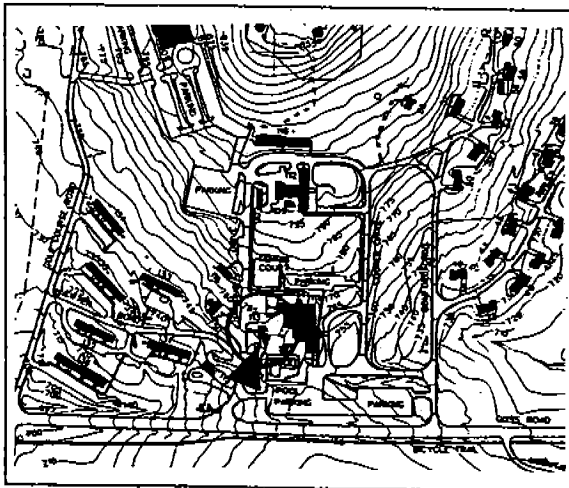
Photo# 9, 10

**9. DESCRIPTION**

Two-story building with rectangular plan and flat roof. Corrugated metal replacement siding and concrete slab foundation. One-over-one double-hung sash replacement windows and metal replacement doors.

**10. SIGNIFICANCE**

Built as communications building; operated by U.S. Army Signal Corps as telephone exchange in 1940s and 1950s. Not an exceptionally important resource within Cold War historic context for proposed Guided Missile Center Historic District.

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

114

**5. CONDITION**

Good

**2. LOCATION**

Ward Mountain

**6. INTEGRITY**

Fair

**3. CONSTRUCTION DATE**

1942

**7. NRHP ASSESSMENT**

Eligible

**4. USE (Original/Current)**

Fire Station / Morale Support Activities

**8. PHOTOGRAPHY**

Roll # 2

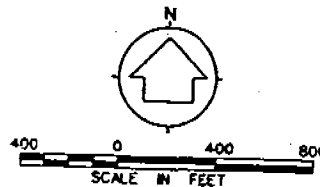
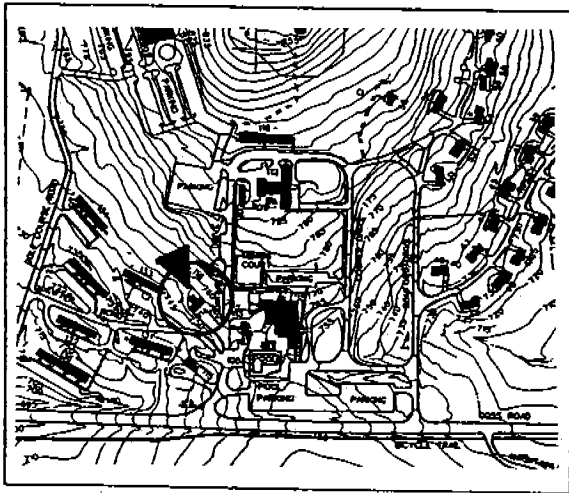
Photo# 7, 8

**9. DESCRIPTION**

Two-story building with T plan and flat roof. Corrugated metal replacement siding and concrete slab foundation. One-over-one double-hung sash replacement windows and metal replacement doors.

**10. SIGNIFICANCE**

G&C machine shops ca. 1950-1957. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

115

**5. CONDITION**

Fair

**2. LOCATION**

Ward Mountain

**6. INTEGRITY**

Good

**3. CONSTRUCTION DATE**

1942

**7. NRHP ASSESSMENT**

Not eligible

**4. USE (Original/Current)**

Heating Plant / Heating Plant

**8. PHOTOGRAPHY**

Roll # 2

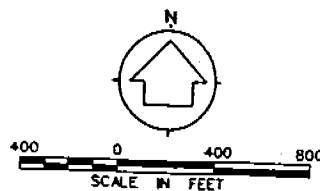
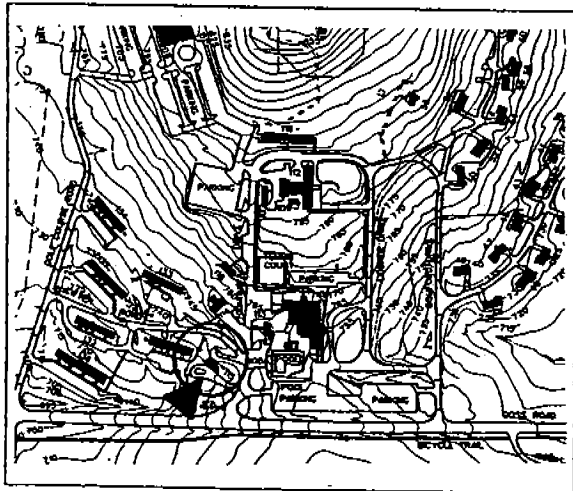
Photo# 13, 14

**9. DESCRIPTION**

One-story building with rectangular plan and flat roof. Masonry veneer exterior and concrete slab foundation. Three-light metal-frame hopper windows and metal replacement doors.

**10. SIGNIFICANCE**

Not an exceptionally important resource within Cold War historic context for proposed Guided Missile Center Historic District.

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.



# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

116

**5. CONDITION**

Fair

**2. LOCATION**

Ward Mountain

**6. INTEGRITY**

Fair

**3. CONSTRUCTION DATE**

1942

**7. NRHP ASSESSMENT**

Eligible

**4. USE (Original/Current)**

Quarters / Offices

**8. PHOTOGRAPHY**

Roll # 1

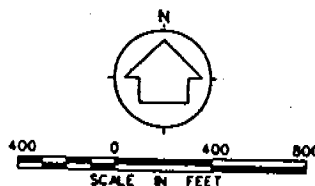
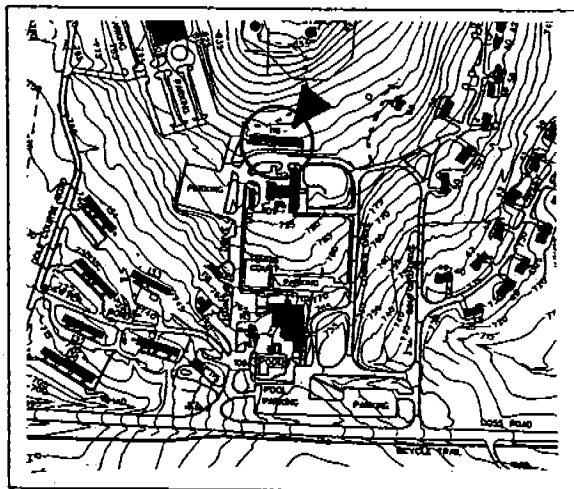
Photo# 29, 30

**9. DESCRIPTION**

One-story building with rectangular plan and flat roof. Corrugated metal replacement siding and concrete slab foundation. One-over-one double-hung sash replacement windows and metal replacement doors.

**10. SIGNIFICANCE**

Nurses' Quarters during WWII. Served as G&C offices ca. 1950-1957. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

118

**5. CONDITION**

Fair

**2. LOCATION**

Ward Mountain

**6. INTEGRITY**

Fair

**3. CONSTRUCTION DATE**

1942

**7. NRHP ASSESSMENT**

Eligible

**4. USE (Original/Current)**

Quarters / Daley Hall, Morale Support Activities

**8. PHOTOGRAPHY**

Roll # 2

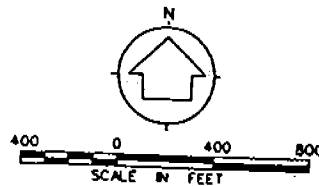
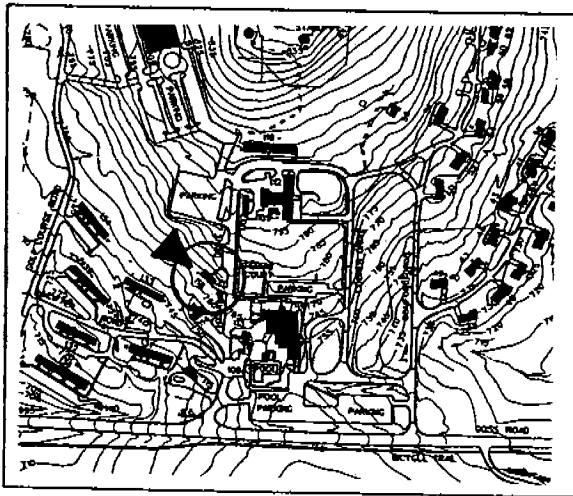
Photo# 5, 6

**9. DESCRIPTION**

Two-story building with rectangular plan and flat roof. Corrugated metal replacement siding and concrete slab foundation. One-light fixed-sash replacement windows and metal replacement doors. One-story entrance portico with doric columns.

**10. SIGNIFICANCE**

Medical detachment barracks during WWII. Used as G&C Electrical Network Design Office in early 1950s. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

## 1. BUILDING NUMBER

4381

## 5. CONDITION

Good

## 2. LOCATION

Plants Area No. 1

## 6. INTEGRITY

Fair

## 3. CONSTRUCTION DATE

1942

## 7. NRHP ASSESSMENT

Eligible

## 4. USE (Original/Current)

Manufacturing plant; office & locker / Admin  
and Lab

## 8. PHOTOGRAPHY

Roll # 6

Photo# 13, 14

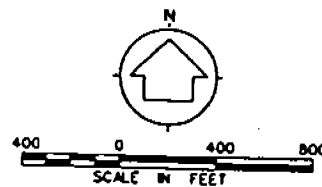
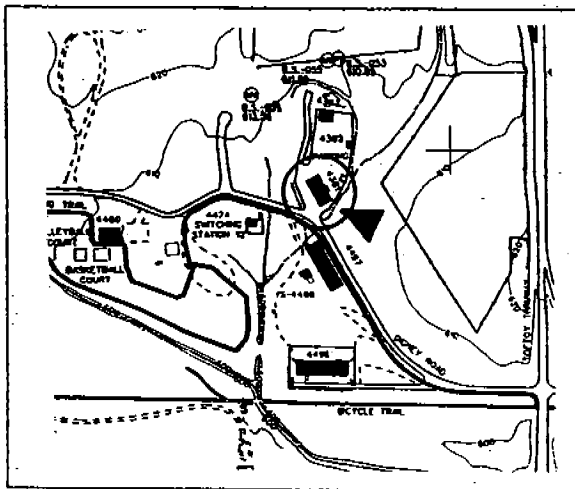
## 9. DESCRIPTION

One-story building with rectangular plan and flat roof. Corrugated metal replacement siding and concrete slab foundation. One-over-one double-hung sash replacement windows and metal replacement doors.

## 10. SIGNIFICANCE

OML Structures and Mechanics Laboratory facility (ca. 1956). Labs for corrosion and surface protection, ceramics, organic chemistry, and plating fabrication. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

## 11. LOCATION MAP



## 12. SURVEYOR

Kip Wright, Historic Resource Assessments

## 13. SURVEY DATE

June 1999

## 14. SOURCES OF INFORMATION

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

## 1. BUILDING NUMBER

4424

## 5. CONDITION

Excellent

## 2. LOCATION

Plants Area No. 1

## 6. INTEGRITY

Fair

## 3. CONSTRUCTION DATE

1942

## 7. NRHP ASSESSMENT

Not eligible

## 4. USE (Original/Current)

Fire Station / Fire Station

## 8. PHOTOGRAPHY

Roll # 2

Photo# 25, 27

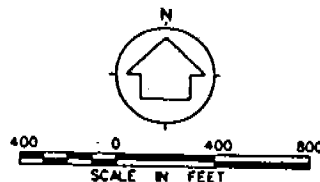
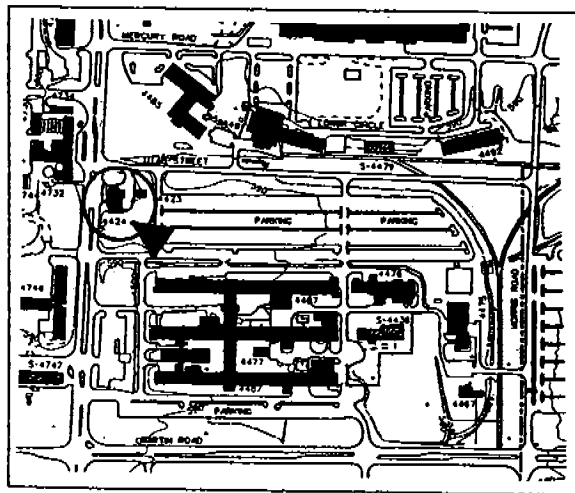
## 9. DESCRIPTION

Two-story building with L plan, large side addition, and flat roof. Corrugated metal replacement siding and concrete slab foundation. One-over-one double-hung sash replacement windows and metal replacement doors. Garage bays on front elevation with overhead metal doors for emergency vehicles.

## 10. SIGNIFICANCE

Not an exceptionally important resource within Cold War historic context of Redstone Arsenal.

## 11. LOCATION MAP



## 12. SURVEYOR

Kip Wright, Historic Resource Assessments

## 13. SURVEY DATE

June 1999

## 14. SOURCES OF INFORMATION

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

## 1. BUILDING NUMBER

4484

## 5. CONDITION

Good

## 2. LOCATION

Plants Area No. 1

## 6. INTEGRITY

Fair

## 3. CONSTRUCTION DATE

1955

## 7. NRHP ASSESSMENT

Eligible

## 4. USE (Original/Current)

Admin / Scientific Library

## 8. PHOTOGRAPHY

Roll # 1

Photo# 25, 26

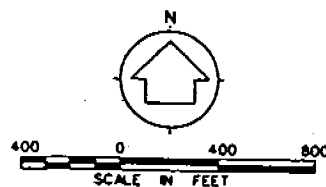
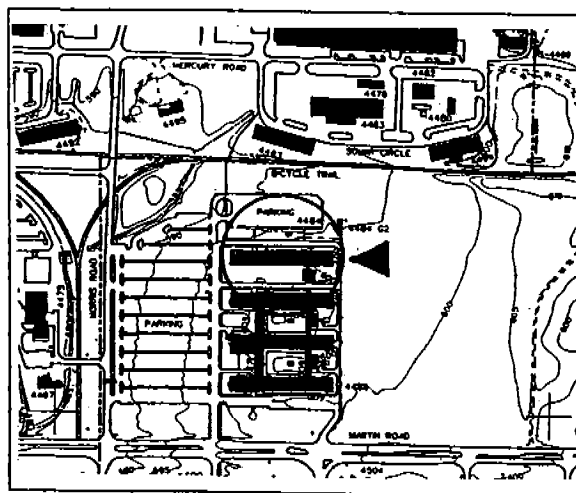
## 9. DESCRIPTION

Continuous concrete foundation; exterior synthetic siding; one-over-one replacement windows; flat roof; three stories; cantilever awning above entrances; rectangular plan; ca. 71,000 square feet.

## 10. SIGNIFICANCE

Used by ABMA as administration building during late 1950s. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

## 11. LOCATION MAP



## 12. SURVEYOR

Kip Wright, Historic Resource Assessments

## 13. SURVEY DATE

June 1999

## 14. SOURCES OF INFORMATION

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

4488

**5. CONDITION**

Good

**2. LOCATION**

Plants Area No. 1

**6. INTEGRITY**

Fair

**3. CONSTRUCTION DATE**

1955

**7. NRHP ASSESSMENT**

Eligible

**4. USE (Original/Current)**

Admin / Admin

**8. PHOTOGRAPHY**

Roll # 1

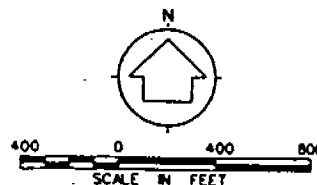
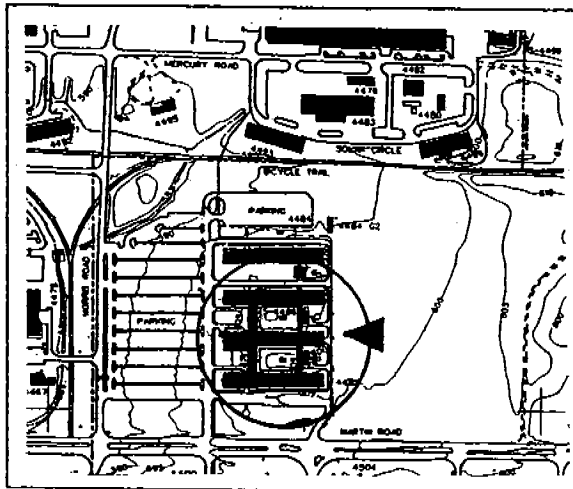
Photo# 23, 24

**9. DESCRIPTION**

Continuous concrete foundation; exterior synthetic siding; one-over-one double-hung-sash replacement windows; flat roof; three stories; continuous cantilever awning above windows; three rectangular parallel wings perpendicularly connected.

**10. SIGNIFICANCE**

Served as ABMA HQ; JUPITER Project Office; ABMA Field Support Division; ABMA Industrial Division; ABMA Development Operations Division; Project Directors for ARPA-NASA (1959). Von Braun office in A-303, Medaris in A-209. Constructed as Research and Development Engineering Building; cost \$2,259,000; begun November 1954. 200,000 square feet of floor. Built by J.A. Jones Construction Co. of Atlanta, GA. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

4489

**5. CONDITION**

Good

**2. LOCATION**

Plants Area No. 1

**6. INTEGRITY**

Fair

**3. CONSTRUCTION DATE**

1958

**7. NRHP ASSESSMENT**

Eligible

**4. USE (Original/Current)**

Technical Photo & T.V. Lab /  
Audio visual

**8. PHOTOGRAPHY**

Roll # 1

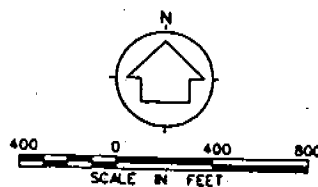
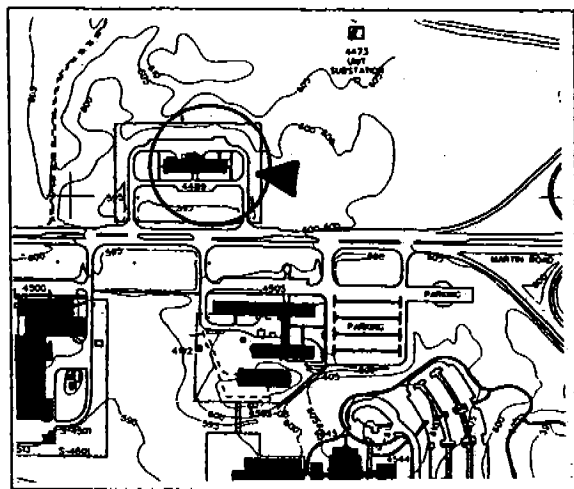
Photo# 15, 16

**9. DESCRIPTION**

Continuous concrete foundation; exterior synthetic siding; one-over-one metal-frame replacement windows; flat roof; two-story center with one-story side wings; rectangular plan; 15,615 square feet.

**10. SIGNIFICANCE**

Used by ABMA to process photographs and films of missile tests. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*

# HISTORIC RESOURCE SURVEY FORM

## 1. BUILDING NUMBER

4496

## 5. CONDITION

Good

## 2. LOCATION

Plants Area No. 1

## 6. INTEGRITY

Good

## 3. CONSTRUCTION DATE

1942

## 7. NRHP ASSESSMENT

Not eligible

## 4. USE (Original/Current)

Chemical storage / Warehouse

## 8. PHOTOGRAPHY

Roll # 6

Photo# 17, 18

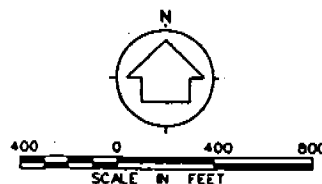
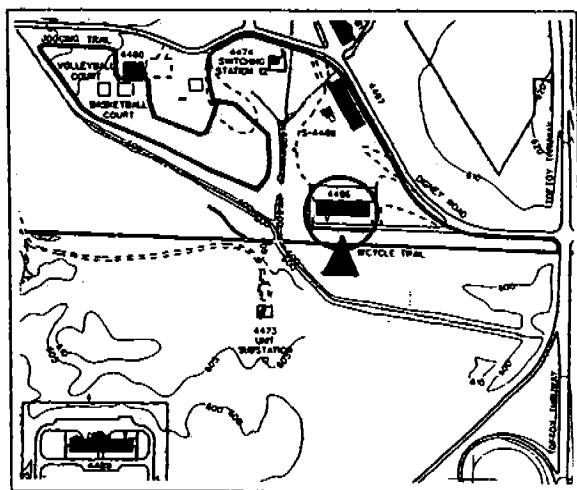
## 9. DESCRIPTION

One-story building with rectangular plan, side-gable metal roof. Brick veneer exterior and concrete slab foundation. Six-over-six double-hung sash windows and metal replacement doors. Concrete water table with splash course.

## 10. SIGNIFICANCE

OML storage, early 1950s. Used by ABMA Operating Services Office, Technical Materials and Equipment Branch, late 1950s. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.

## 11. LOCATION MAP



## 12. SURVEYOR

Kip Wright, Historic Resource Assessments

## 13. SURVEY DATE

June 1999

## 14. SOURCES OF INFORMATION

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.



## ***HISTORIC RESOURCE SURVEY FORM***

## 1. BUILDING NUMBER

4497

## 5. CONDITION

**Good**

## 2. LOCATION

Plants Area No. 1

## 6. INTEGRITY

**Good**

### 3. CONSTRUCTION DATE

1942.

## 7. NRHP ASSESSMENT

**Not eligible**

#### 4. USE (Original/Current)

**Chemical storage / Threat simulator  
management office**

## 8. PHOTOGRAPHY

**Roll # 6**

**Photo# 15, 16**

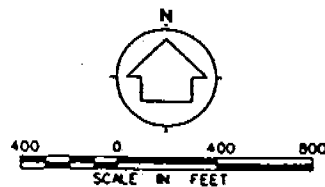
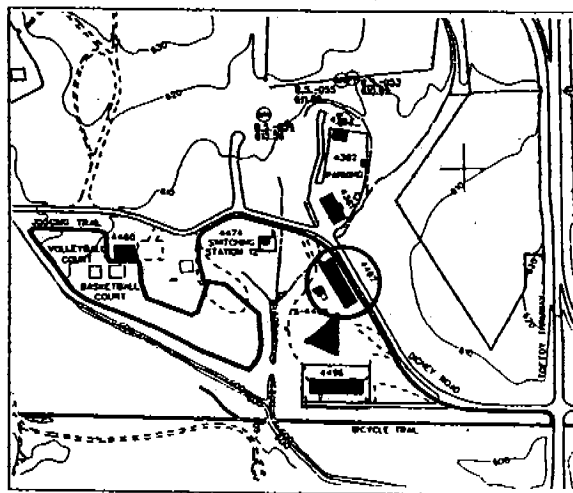
## 9. DESCRIPTION

One-story building with rectangular plan, side-gable metal roof. Brick veneer exterior and concrete slab foundation. Metal replacement doors. Concrete water table with splash course.

## 10. SIGNIFICANCE

Used by OML for storage of lab equipment, early 1950s. Used by ABMA Development Operations Division, Test Laboratory, late 1950s. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.

## 11. LOCATION MAP



## 12. SURVEYOR

### Kip Wright, Historic Resource Assessments

### 13. SURVEY DATE

June 1999

## 14. SOURCES OF INFORMATION

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

## 1. BUILDING NUMBER

4505

## 5. CONDITION

Good

## 2. LOCATION

Plants Area No. 1

## 6. INTEGRITY

Fair

## 3. CONSTRUCTION DATE

1960

## 7. NRHP ASSESSMENT

Eligible

## 4. USE (Original/Current)

Admin / Admin

## 8. PHOTOGRAPHY

Roll # 1

Photo# 17, 18

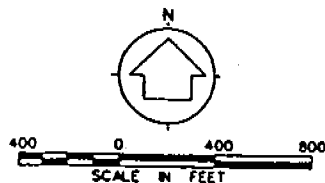
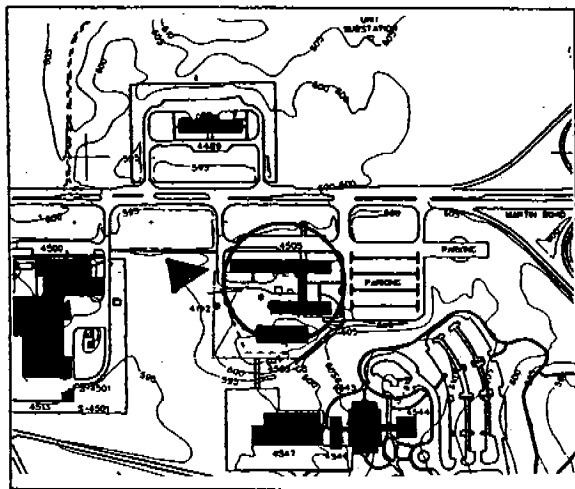
## 9. DESCRIPTION

Continuous concrete foundation; concrete block with exterior synthetic siding; single-light replacement windows; flat roof; three stories; rectangular parallel wings perpendicularly connected; 113,894 square feet.

## 10. SIGNIFICANCE

Built as AOMC HQ and admin offices; Medaris' Office, Room 200; Berry Industries; Continental Army Command Liaison Office; NASA Liaison Office. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. All historical sources indicate 1958 construction date.

## 11. LOCATION MAP



## 12. SURVEYOR

Kip Wright, Historic Resource Assessments

## 13. SURVEY DATE

June 1999

## 14. SOURCES OF INFORMATION

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

## 1. BUILDING NUMBER

4500

## 5. CONDITION

Good

## 2. LOCATION

Plants Area No. 1

## 6. INTEGRITY

Fair

## 3. CONSTRUCTION DATE

1956

## 7. NRHP ASSESSMENT

Not eligible

## 4. USE (Original/Current)

Admin / Admin

## 8. PHOTOGRAPHY

Roll # 1

Photo# 20, 21, 22

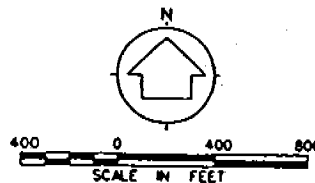
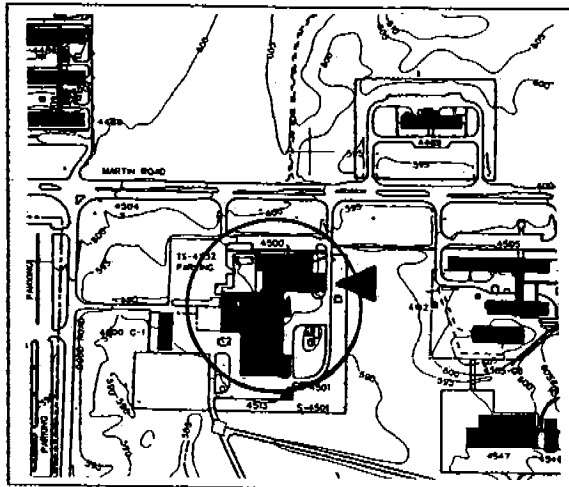
## 9. DESCRIPTION

Continuous concrete foundation; exterior synthetic siding; double-hung metal-frame windows; flat roof; one and one-half stories; irregular plan.

## 10. SIGNIFICANCE

Used by Aerojet General Corporation; Used by ARGMA OML Division in 1959. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.

## 11. LOCATION MAP



## 12. SURVEYOR

Kip Wright, Historic Resource Assessments

## 13. SURVEY DATE

June 1999

## 14. SOURCES OF INFORMATION

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

## 1. BUILDING NUMBER

4722

## 5. CONDITION

Good

## 2. LOCATION

Plants Area No. 1

## 6. INTEGRITY

Fair

## 3. CONSTRUCTION DATE

1941

## 7. NRHP ASSESSMENT

Eligible

## 4. USE (Original/Current)

Inert warehouse / Technical Data  
Division, ADP

## 8. PHOTOGRAPHY

Roll # 1 Photo# 27, 28

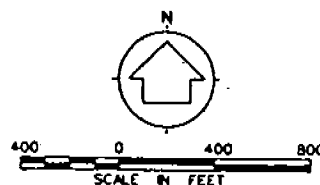
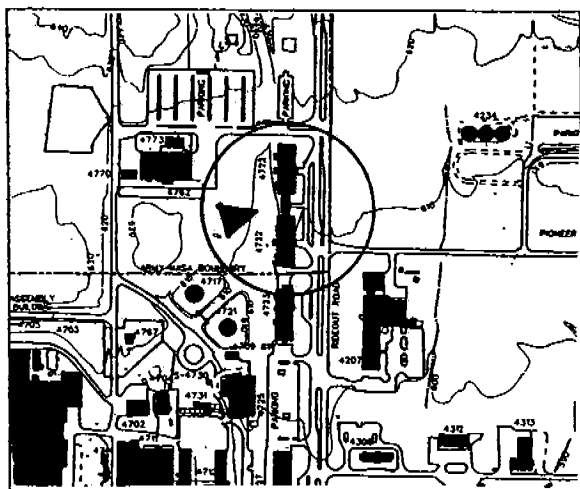
## 9. DESCRIPTION

Concrete block foundation; structural clay tile walls covered with corrugated metal siding [added 1984]; awning and single-sash metal-frame windows; side-gabled corrugated-metal roof; one story; rectangular plan.

## 10. SIGNIFICANCE

OML's Guided Missile Development Division HQ and Structures and Mechanics Lab in early 1950s. Used by Chrysler Corporation, Admin Services, Guidance and Control; Ford Instrument Company; ABMA Industrial Division; ABMA Development Operations Division, Guidance and Control Laboratory in 1959. Similar to 4723, 4727, 4728, 4485, 4491-4494. Standard warehouse structure for Huntsville Arsenal. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Design attributed to Whitman, Requardt, & Smith; Baltimore, MD.

## 11. LOCATION MAP



## 12. SURVEYOR

Kip Wright, Historic Resource Assessments

## 13. SURVEY DATE

June 1999

## 14. SOURCES OF INFORMATION

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*.

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

4725

**5. CONDITION**

Fair

**2. LOCATION**

Plants Area No. 1

**6. INTEGRITY**

Excellent

**3. CONSTRUCTION DATE**

1942

**7. NRHP ASSESSMENT**

Not eligible

**4. USE (Original/Current)**

Heating Plant / Steam Plant

**8. PHOTOGRAPHY**

Roll # 2

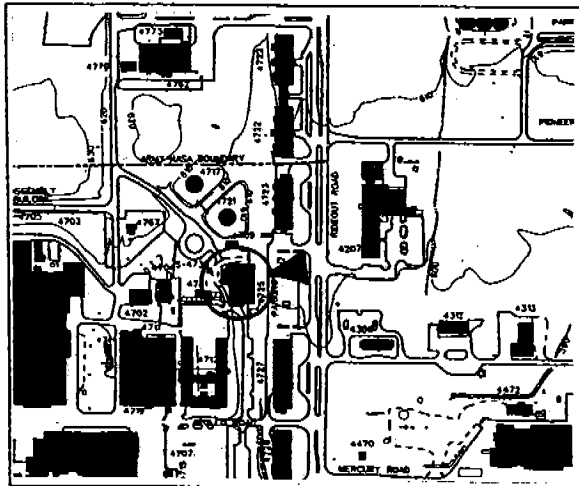
Photo# 17, 18

**9. DESCRIPTION**

Large, multi-story building with rectangular plan, flat roof. Poured concrete exterior features pilasters. Concrete slab foundation. Metal casement windows and doors. Roof has four hooded smoke stacks.

**10. SIGNIFICANCE**

Served as main heating plant for Huntsville Arsenal. Later used for same purpose by Army and NASA. Not an exceptionally important resource within Cold War historic context of Redstone Arsenal.

**11. LOCATION MAP**

# HISTORIC RESOURCE SURVEY FORM

**1. BUILDING NUMBER**

7132

**5. CONDITION**

Fair

**2. LOCATION**

Former Redstone Ordnance Plant area

**6. INTEGRITY**

Excellent

**3. CONSTRUCTION DATE**

1945

**7. NRHP ASSESSMENT**

Eligible

**4. USE (Original/Current)**

Admin / Courtroom

**8. PHOTOGRAPHY**

Roll # 1

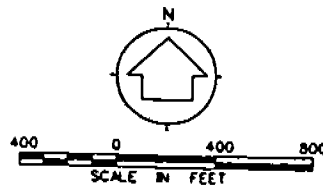
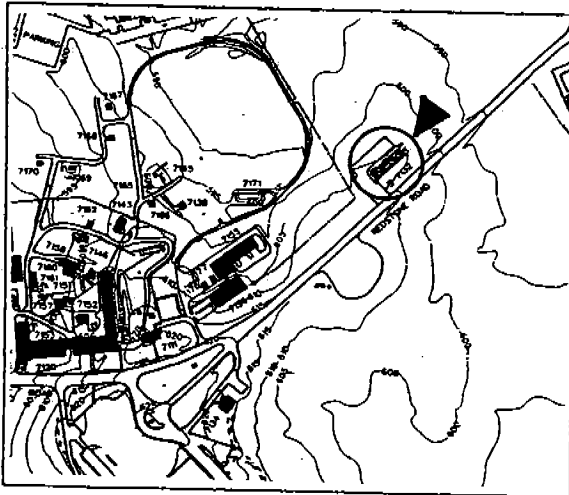
Photo# 1, 2

**9. DESCRIPTION**

Small, one-story building with rectangular plan, side-gable roof. Balloon-frame building with wooden drop siding. Concrete slab foundation. Wooden eight-over-eight double-hung sash windows. Four-light wooden doors. Asphalt-shingle roof with metal vent stacks.

**10. SIGNIFICANCE**

Site of Nickerson Court-martial. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. [Note: Demolished in 1999 as per 1996 memorandum of agreement.]

**11. LOCATION MAP****12. SURVEYOR**

Kip Wright, Historic Resource Assessments

**13. SURVEY DATE**

June 1999

**14. SOURCES OF INFORMATION**

Please refer to bibliography in *Rocket Science: A Historic Context and Assessment of U.S. Army Cold War Properties, 1946-1989*

**APPENDIX IV.**

**RESULTS FROM FIELD SURVEY**

# APPENDIX IV.

## RESULTS FROM FIELD SURVEY

BLDG # new/old	Present Use	Original Use	Built	Manager	Integrity	NRHP	Comments
109	Unknown	Unknown	1962	Army	Excellent	Not Eligible	Not an exceptionally important resource within Cold War historic context for proposed Guided Missile Center Historic District.
110 / 112A	Supply Services Admin	Medical clinic	1943	Army	Fair	Eligible	Originally a pre-employment medical clinic for Huntsville Arsenal. Guidance and Control (G&C) precision machine shop ca. 1950-1957. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
111	Administration	Huntsville Arsenal HQ	1942	Army	Fair	Eligible	HQ for Ordnance Guided Missile Center beginning in 1949. Von Braun's office here 1950-1956. Served as Officers' Open Mess in late 1950s. Converted to office space in 1985. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
112	RASA HQ	Hospital	1942	Army	Fair	Eligible	G&C Laboratory 1950-1957. Used by ABMA Development Operations Division, Missile Instrumentation Development Branch as late as 1959. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
113	Morale Support Activities	Signal Corps Office Building	1942	Army	Fair	Not Eligible	Built as communications building; operated by U.S. Army Signal Corps as telephone exchange in 1940s and 1950s. Not an exceptionally important resource within Cold War historic context for proposed Guided Missile Center Historic District.
114	Morale Support Activities	Fire Station	1942	Army	Fair	Eligible	G&C machine shops ca. 1950-1957. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
115	Heating Plant	Heating Plant	1942	Army	Good	Not Eligible	Not an exceptionally important resource within Cold War historic context for proposed Guided Missile Center Historic District.
116 / 116 & 117	Offices	Quarters	1942	Army	Fair	Eligible	Nurses' Quarters during WWII. Served as G&C offices ca. 1950-1957. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
118	Daley Hall, Morale Support Activities	Quarters	1942	Army	Fair	Eligible	Medical detachment barracks during WWII. Used as G&C Electrical Network Design Office in early 1950s. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4313 / 313	Storage	Unknown	1943	NASA	Excellent	Not Evaluated	Used by OML Structures Laboratory in early 1950s. Served as Field Service Office for Rocketdyne Division in 1959. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4381 / 251	Admin/Lab	Manufacturing plant; office & locker	1942	Army	Fair	Eligible	OML Structures and Mechanics Laboratory facility (ca. 1956). Labs for corrosion and surface protection, ceramics, organic chemistry, and plating fabrication. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.



4424 / 424	Fire Station	Fire Station	1942	Army	Fair	Not Eligible	Not an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4471 / 471	Office/storage	Chemical munitions assembly building	1943	NASA	Fair	Not Evaluated	OML storage building in early 1950s. Used by ABMA Operating Services Office, Technical Materials and Equipment Branch in 1959. Similar to 4481. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4476	MAST/FSL Simulation facility		1963	NASA	Good	Not Evaluated	Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4477	Audio reverberant facility		1991	NASA	Excellent	Not Evaluated	Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4479 / 479	Storage		1942	NASA	Good	Not Evaluated	Used as supply storage area by OML and, later, ABMA Operating Services Office, Technical Materials and Equipment Branch. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4481 / 481	Space Science Laboratory	Chemical munitions assembly building	1943	NASA	Good	Not Evaluated	Contained OML Guided Missile Library, Inspection Laboratory, Launching and Handling Special Equipment Shop, and Guided Missile Assembly Shop in early 1950s. By 1959 was used by U.S. Association for Technical Assistants; Chrysler Corporation, Mechanical Dept.; ABMA Development Operations Division, Systems Support Equipment Laboratory. Similar to 4471. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4484	Scientific Library	Admin	1955	Army	Fair	Eligible	Used by ABMA as administration building during late 1950s. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4485 / 485	Office Building	Warehouse	1943	NASA	Good	Not Evaluated	Used by OML as Aeroballistics Lab, admin, design, and engineering, ca. 1955. Used by ABMA Development Operations Division, Guidance & Control Laboratory; PERSHING G&C Liaison Office in late 1950s. Similar to 4723, 4727, 4728, 4491-4494 (4722 has metal siding). Standard warehouse structure for Huntsville Arsenal. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4487/487A, 487B, & 487C	Office Building/Laboratory	Guidance & Control Laboratory and Shops	1957	NASA	Fair	Not Evaluated	Used by ABMA Development Operations Division, Guidance and Control Laboratory, Director; PERSHING Project Engineer (1959). 1959 addition. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4488 / 488	Admin	Admin	1955	Army	Fair	Eligible	Served as ABMA HQ; JUPITER Project Office; Air Force JUPITER Liaison Office; SAC Liaison Office; ABMA Field Support Division; ABMA Industrial Division; ABMA Development Operations Division, Project Directors for ARPA-NASA, Jupiter, Redstone & Pershing, Aeroballistics Laboratory, Computation Laboratory, Missile Firing Laboratory, Research Projects Laboratory (1959). Von Braun office in A-303, Medaris in A-209. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4489	Audio visual	Technical Photo & T.V. Lab	1958	Army	Fair	Eligible	Used by ABMA to process photographs and films of missile tests. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

4491 / 491	Documentation Repository	Warehouse	1943	NASA	Good	Not Evaluated	Served as OML Computations Laboratory ca. 1955. Contained IBM computers. Used by ABMA Development Operations Division, Guidance & Control Laboratory ca. 1959. Similar to 4723, 4727, 4728, and 4485 (4722 has metal siding). 4491-4494 are standard warehouse structures built for Huntsville Arsenal. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4492 / 492	Office Building	Warehouse	1943	NASA	Good	Not Evaluated	Used by OML as warehouse, early 1950s. Converted to ABMA Development Operations Division, Guidance & Control Laboratory, late 1950s. Similar to 4723, 4727, 4728, and 4485 (4722 has metal siding). 4491-4494 are standard warehouse structures built for Huntsville Arsenal. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4493 / 493	Microgravity Development Center	Warehouse	1943	NASA	Good	Not Evaluated	Used by OML to store lab equipment, early 1950s. Used by ABMA Development Operations Division, Guidance and Control Laboratory, late 1950s. Similar to 4723, 4727, 4728, and 4485 (4722 has metal siding). 4491-4494 are standard warehouse structures built for Huntsville Arsenal. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4494 / 494	Child Development Center	Warehouse	1943	NASA	Good	Not Evaluated	OML missile manufacturing equipment storage, early 1950s. Used by ABMA Operating Services Office, Technical Materials and Equipment Branch ca. 1958. Does not fit within Cold War historic context of proposed ABMA historic district. Similar to 4723, 4727, 4728, and 4485 (4722 has metal siding). 4491-4494 are standard warehouse structures built for Huntsville Arsenal. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4495 / 246	Shop		1942	NASA	Good	Not Evaluated	Used by Post Engineer, early 1950s. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4496 / 281	Warehouse	Chemical storage	1942	Army	Good	Not Eligible	OML storage, early 1950s. Used by ABMA Operating Services Office, Technical Materials and Equipment Branch, late 1950s. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4497 / 282	Threat simulator management office	Chemical storage	1942	Army	Good	Not Eligible	Used by OML for storage of lab equipment, early 1950s. Used by ABMA Development Operations Division, Test Laboratory, late 1950s. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4500 / 499	Admin	Admin	1956	Army	Fair	Not Eligible	Used by Aerojet General Corporation; Used by ARGMA OML Division in 1959. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4505	Admin	Admin	1960	Army	Fair	Eligible	Built as AOMC HQ and admin offices; Medaris' Office, Room 200; Berry Industries; Continental Army Command Liaison Office; NASA Liaison Office. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. All historical sources indicate 1958 construction date.
4533	Test Facility Terminal Bldg	Static Test Stand	1965	NASA	Good	Not Evaluated	Static test stand w/motor. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4534 / 274	Hot Gas Test Facility		1962	NASA	Good	Not Evaluated	Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4564 / 276	TPTA Refurbishment Facility	Horizontal Firing Test Stand	1987	NASA	Poor	Not Evaluated	Built by ABMA as power plant test stand and used by Development Operations Division, Test Laboratory in late 1950s. Part of REDSTONE-JUPITER test facilities. Original 1957 structure rebuilt 1987, no longer retains integrity.

4566 / 266	Office Building	Engineering Building	1957	NASA	Fair	Not Evaluated	Built by ABMA as part of REDSTONE-JUPITER test facilities. Stored classified test data on missile static firings. Used by Hayes Aircraft Corporation; ABMA Development Operations Division, Test Laboratory; Rocketdyne Division, Test and Development Offices in late 1950s. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4567 / 267	Boiler House & Pump Station	Boiler House & Pump Station	1957	NASA	Good	Not Evaluated	Built by ABMA as part of REDSTONE-JUPITER test facilities. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4570 / 270	Blockhouse	Blockhouse	1956	NASA	Good	Not Evaluated	Blockhouse for ABMA Development Operations Division, Test Laboratory. Contained control and instrumentation for static test tower, horizontal firing test stand, and cold calibration test stand. Connected to computer system in 4619. Part of REDSTONE-JUPITER test facilities. Used in development of SATURN. Doubled in size after 1962. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4572 / 271	Static Test Stand	Static Test Stand	1957	NASA	Excellent	NHL	Propulsion and Structural Test Facility. Built by ABMA to test solid rocket motors. Part of REDSTONE-JUPITER test facilities and used in development of SATURN. First stage SATURN I vehicle located on northeast side. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. National Historic Landmark. Sources indicate 1956 construction date.
4581	Nitrogen gas storage facility		1957	NASA	Good	Not Evaluated	Used by ABMA Development Operations Division, Test Laboratory in 1959. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4582 / 272	Storage	Compressed Gas Storage	1957	NASA	Good	Not Evaluated	Built by ABMA as compressor station and storage facility for high-pressure gas. Part of REDSTONE-JUPITER test facilities. Used by Development Operations Division, Test Laboratory in late 1950s. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4583 / 273	Test & Data Recording Facility	Components Test Laboratory	1957	NASA	Fair	Not Evaluated	Built by ABMA and used as test laboratory for Development Operations Division. Part of REDSTONE-JUPITER test facilities. Large addition after 1962 for use in SATURN program. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4588 / 274B	Cold Calibration Test Stand	Cold Calibration Test Stand	1957	NASA	Good	Not Evaluated	Built by ABMA as part of REDSTONE-JUPITER test facilities. Ca. 1960 addition for SATURN program. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4610	Office & Engineering Building	Part of Structures & Mechanics Laboratory	1959	NASA	Excellent	Not Evaluated	Used by ABMA Development Operations Division, Structures and Mechanics Laboratory. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Historical sources indicate 1958 construction date.
4612	Materials & Processes Building	Part of Structures & Mechanics Laboratory	1959	NASA	Excellent	Not Evaluated	Used by ABMA Development Operations Division, Structures and Mechanics Laboratory. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Historical sources indicate 1958 construction date.

4619	Structural Dynamics & Thermal Vacuum Lab	Part of Structures & Mechanics Laboratory	1959	NASA	Good	Not Evaluated	Used by ABMA Development Operations Division, Structures and Mechanics Laboratory; Ralph M. Parsons Co. Field Office (1959). Contained computers for blockhouse (4570), which served as control center for Solid Motor Structural Test Facility (4572). Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Historical sources indicate 1958 construction date.
4620	HP Pneumatic Facility		1959	NASA	Good	Not Evaluated	Used by ABMA Development Operations Division, Structures and Mechanics Laboratory. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4650	Shop & Calibration Lab	Guided Missile Test Shop	1958	NASA	Good	Not Evaluated	Used by ABMA Development Operations Division, Systems Analysis and Reliability Laboratory, Test Laboratory in 1959. Similar to 4707 and 4708. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Historical sources indicate 1957 construction date.
4663	Computer Facility	Computation Laboratory	1959	NASA	Fair	Not Evaluated	Used by Burroughs Computer Maintenance; General Electric Corporation; ABMA Development Operations Division, Computation Laboratory in 1959. Now used by Space/9 Missions Operations Control. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Historical sources indicate 1958 construction date.
4665 / 465	Historic Redstone Test Site	Test Stand	1953	NASA	Excellent	NHL	Built by OML as Interim Test Stand. Used by ABMA Development Operations Division, Test Laboratory. Blockhouse built from steel railroad tank cars. First static-firing test facility constructed in area. First launch vehicle test stand in U.S. Previous ones were for motor testing. Technical advances in launch pneumatics, thrust measurement, propellant fill procedures, and launch ignition procedures occurred at this site. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. National Historic Landmark.
4702 / 402	Non-destructive Evaluation Facility	Systems Analysis & Reliability Laboratory Facility	1955	NASA	Good	Not Evaluated	Used by OML, early 1950s. Maps indicate original building constructed ca. 1953. Served as ABMA Development Operations Division, Systems Analysis and Reliability Laboratory, in late 1950s, for high-pressure test, analysis, and inspection of missile systems. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4703(s)/ 405C	Storage	Missile Assembly Shop	1959	NASA	Poor	Not Evaluated	Built as part of OML missile assembly shop, 1954-1955. Appears to have been rebuilt. Maps indicate original building constructed ca. 1954.
4704 / 404	Heat Treat Facility	Missile Component Shop	1952	NASA	Good	Not Evaluated	OML missile component shop, early 1950s. Used by ABMA Development Operations Division, Fabrication and Assembly Engineering Laboratory, late 1950s. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.

4705 / 405, 405A	Shop and Neutral Buoyancy Simulator	Missile Assembly Shop	1955	NASA	Good	NHL	Built as OML missile assembly shop, 1954-1955. Maps indicate original building constructed in 1954. Used by Chrysler Corporation, Quality Assurance; ABMA Development Operations Division, Fabrication and Assembly Engineering Laboratory, Systems Analysis and Reliability Laboratory; Rocketdyne Division, Field Service Office after 1955. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. National Historic Landmark.
4707 / 405B	Productivity Enhancement Complex	Structural Fabrication Laboratory	1956	NASA	Good	Not Evaluated	Originally OML and ABMA structural fabrication facility. Maps indicate original building constructed 1955. Similar to 4708 and 4650. Large addition completed in 1957. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4708	Engineering & Development Lab	Missile Assembly Inspection Hanger	1957	NASA	Fair	Not Evaluated	ABMA Development Operations Division, Systems Analysis and Reliability Laboratory; Rocketdyne Division, Field Service Office-CM&R Lab (1959). Similar to 4707 and 4650. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4711 / 411	Developmental Processes Lab		1943	NASA	Fair	Not Evaluated	Used as OML machine shop for fabricating missiles, early 1950s. Chrysler Corporation, Operations Service Branch; ABMA Development Operations Division, Fabrication and Assembly Engineering Laboratory, Systems Analysis and Reliability Laboratory (1959). Expanded ca. 1957. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4712 / 412 & 412A	Office Building		1943	NASA	Good	Not Evaluated	Former OML buildings combined and expanded ca. 1958 to serve as ABMA Development Operations Division, Fabrication and Assembly Engineering Laboratory, Systems Analysis and Reliability Laboratory. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4714 / 414	Mechanical Equipment Building		1943	NASA	Good	Not Evaluated	OML missile tube cleaning and treatment facility, early 1950s. ABMA Development Operations Division, Fabrication and Assembly Engineering Laboratory, late 1950s. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4715 / 415	Storage Building		1943	NASA	Excellent	Not Evaluated	OML electrical shop used for Test Laboratory, early 1950s. Used by ABMA Development Operations Division, Fabrication and Assembly Engineering Laboratory, late 1950s. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4716 / 416	Test Control Building		1943	NASA	Good	Not Evaluated	Used by OML as pipefitting shop. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.

4722 / 421 & 422	Technical Data Division, ADP Building	Inert Warehouse	1941	Army	Fair	Eligible	Used as OML's Guided Missile Development Division HQ and Structures and Mechanics Lab in early 1950s. Used by Chrysler Corporation, Admin Services, Guidance and Control; Ford Instrument Company; ABMA Industrial Division; ABMA Development Operations Division, Guidance and Control Laboratory in 1959. Similar to 4723, 4727, 4728, 4485, 4491-4494 (4722 has metal siding). Standard warehouse structure for Huntsville Arsenal. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4723 / 423	Flight Hardware Parts Storage	Warehouse	1943	NASA	Fair	Not Evaluated	OML Materials Testing Lab in early 1950s. Used as ABMA Development Operations Division, Fabrication and Assembly Engineering Laboratory, Guidance and Control Laboratory, Structures and Mechanics Laboratory in 1959. Similar to 4727, 4728, 4485, 4491-4494 (4722 has metal siding). Standard warehouse structure for Huntsville Arsenal. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4725 / 425 & 426	Steam Plant	Heating Plant	1942	Army	Excellent	Not Eligible	Served as main heating plant for Huntsville Arsenal. Later used for same purpose by Army and NASA. Not an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4727 / 427	Office Building	Warehouse	1943	NASA	Fair	Not Evaluated	OML missile component machine shop, early 1950s. Used by ABMA Development Operations Division, Fabrication and Assembly Engineering Laboratory in late 1950s. Similar to 4723, 4728, 4485, 4491-4494 (4722 has metal siding). Standard warehouse structure for Huntsville Arsenal. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4728 / 428	Shop & Storage Building	Warehouse	1943	NASA	Fair	Not Evaluated	OML Test Laboratory machine shop, early 1950s. Used by ABMA Development Operations Division, Fabrication and Assembly Engineering Laboratory late 1950s. Similar to 4723, 4727, 4485, 4491-4494 (4722 has metal siding). Standard warehouse structure for Huntsville Arsenal. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4731	Storage Building		1959	NASA	Excellent	Not Evaluated	Rebuilt on foundation of 426B. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4732	Office & Wind Tunnel Facility		1943	NASA	Excellent	Not Evaluated	Recently constructed building on site of ABMA Aeroballistics Laboratory wind tunnel.
4733	Impulse Base Flow Facility		1953	NASA	Excellent	Not Evaluated	Does not fit within ABMA period of significance. Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4737	Dry Air Storage Tank	Storage tank	1953	NASA	Good	Not Evaluated	Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal. Historical sources indicate 1952 construction date.
4744	Compressed Air Facility		1960s	NASA	Excellent	Not Evaluated	Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
4746 / 432, 433, & 434	Office Building		1943	NASA	Excellent	Not Evaluated	OML Test Laboratory offices, Instrumentation Development Laboratory, and Special Test Facility Measuring Center, and Guided Missile Design Section, early 1950s. Used by ABMA Development Operations Division, Test Laboratory, late 1950s. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4747 / 435		Compressor Station	1951	NASA	Excellent	Not Evaluated	New building (1999) constructed on site of Building 435, OML/ABMA Compressor Station.

4760	Surface Treatment Facility		1959	NASA	Fair	Not Evaluated	Originally used by ABMA Development Operations Division, Systems Analysis and Reliability Laboratory. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context.
4776	Low Density Flow Facility		1965	NASA	Excellent	Not Evaluated	Does not appear to be an exceptionally important resource within Cold War historic context of Redstone Arsenal.
7132	Courtroom	Admin	1945	Army	Excellent	Eligible	Site of Nickerson Court-martial. Associated with the people, programs, or events considered exceptionally important within the Redstone Arsenal Cold War Historic Context. Demolished in 1999 as per 1996 memorandum of agreement.

**APPENDIX V.**

**BUILDINGS THAT WILL REACH 50 YEARS OF AGE  
WITHIN THE NEXT FIVE YEARS**



## APPENDIX V.

### BUILDINGS THAT WILL REACH 50 YEARS OF AGE WITHIN THE NEXT FIVE YEARS

Within the next five years, the buildings on this chart will all reach 50 years of age. At that time, they will become potentially NRHP eligible because of their age. A portion of the resources allocated to historic resource management projects in the immediate future should be devoted to their survey, evaluation, and documentation. These resources are associated with either the Ordnance Guided Missile School or the Army Ordnance Rocket Center, facilities developed at Redstone Arsenal in the early 1950s.

BLDG #	Cold War Use	Built	Comments
3200	Enlisted Barracks	1955	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3201	Enlisted Barracks	1955	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3202	Enlisted Barracks	1955	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3210	Enlisted Barracks	1955	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3216	Enlisted Barracks	1956	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3217	Enlisted Barracks	1955	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3301	Missile School Training	1955	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3302	Missile School Training	1955	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3303	Missile School Training	1958	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3304	Missile School Training	1955	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3305	Missile School Training	1958	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3306	Missile School Training	1958	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3307	Missile School Training	1958	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3308	Missile School Training	1958	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953

3480	Barracks	1955	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
3481	Barracks	1956	May be eligible as part of potential historic district for Ordnance Guided Missile School, which was established in February 1953
7120	Headquarters and Library	1953	Maintains some interesting architectural features despite exterior renovation. May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7156	Administration, R&D	1952	May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7595	Propellant Facility	1955	May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7632	Chemistry Laboratory	1955	May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7650	Administration	1953	Former Thiokol Corporation headquarters. High level of integrity. Good example of modern architecture. May be eligible individually or as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7770	Administration & Laboratory	1951	Josiah C. Gorgas Laboratory. Former Rohm and Haas Company headquarters. High level of integrity. Good example of modern architecture. May be eligible individually or as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7808	Propulsion System Building	1956	May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7820	Blockhouse	1953	May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7821	Firing Bay	1953	May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7822	Firing Bay	1953	May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7856	Blockhouse	1953	May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7858	Static Test Facility	1953	May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
7861	Static Test Facility	1953	May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949
No number assigned	Missile Sled with Dual Track	Ca. 1955	Located in Test Area 1. May be eligible as part of potential historic district for Army Ordnance Rocket Center, which was established in the former Redstone Ordnance Plant area in 1949